Department for Environment Food & Rural Affairs

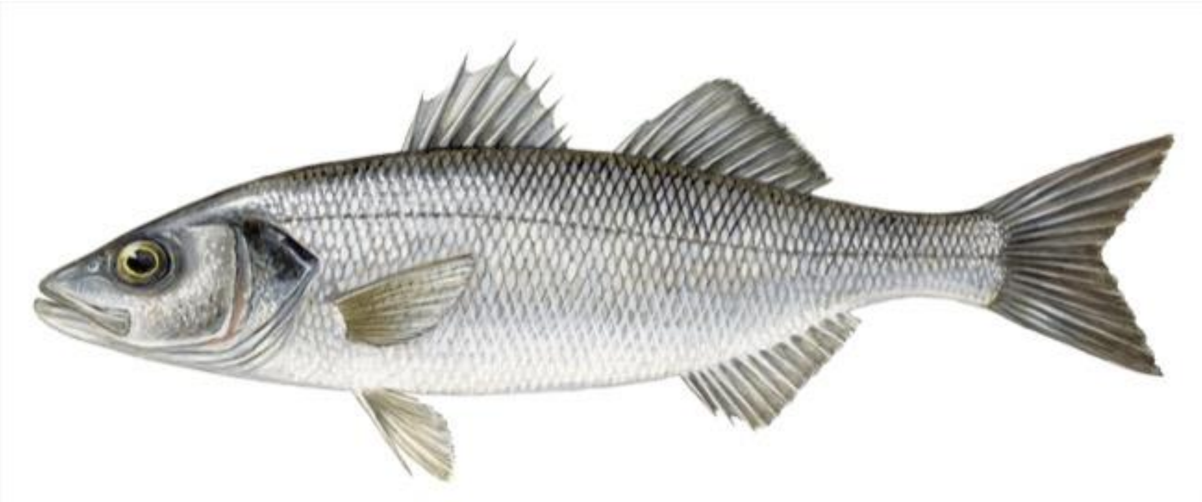
Llywodraeth Cymru
Welsh Government

Proposed Fisheries Management Plan for Sea bass in English and Welsh Waters

Annexes

Date: July 2023

Version: public consultation



List of Annexes

Annex 1 Key policy linkages

Annex 2 Evidence statement

Annex 3 Bournemouth University report

Annex 4 Stakeholder engagement report

Annex 5 Policy Lab Final Report

Annex 6 Policy Lab Lived Experience Report

Annex 7 Policy Lab Collective Intelligence debate

Annex 8 Policy Lab Codesign summary

Annex 9 Environmental Considerations

Annex 10 Goals

Annex 11 Inshore Fisheries Management Summary

Department
for Environment
Food & Rural Affairs

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Proposed Fisheries Management Plan for Sea bass in English and Welsh Waters

Annex 1: Governance, policy linkages and legislative requirements

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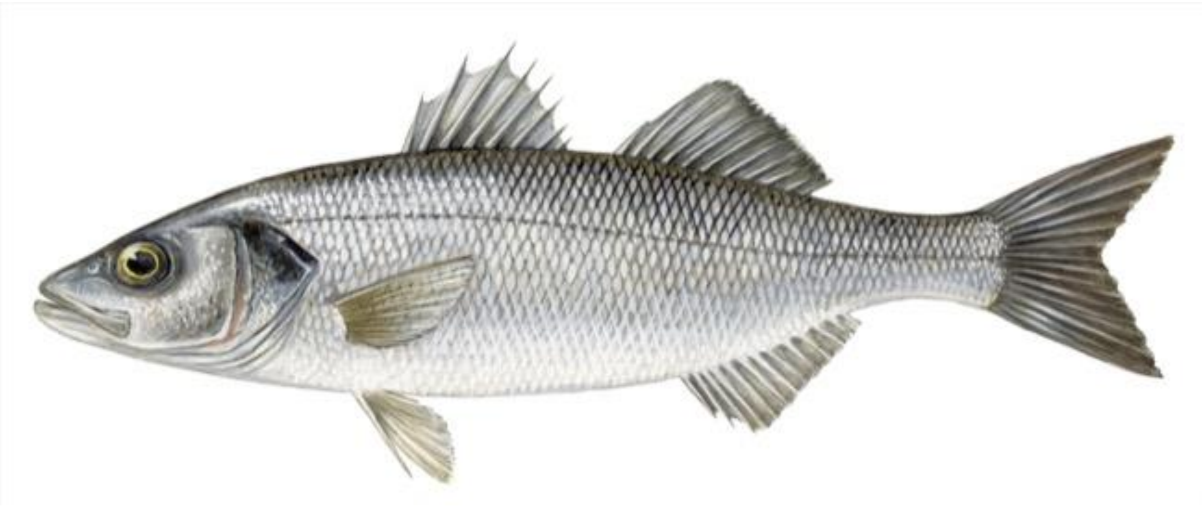

Contents

Governance

Defra is responsible for UK fisheries policy and governance. Fisheries management has been devolved to the Welsh Ministers, Scottish Ministers, is also carried out by devolved fisheries administrations: Welsh Government; Scottish Government; and the Department of Agriculture, Environment and Rural Affairs (DAERA) in Northern Ireland. Collectively, including Defra, these organisations are known as the UK Fisheries Policy Authorities.

Welsh Government Ministers are responsible for fisheries resources in the Welsh inshore region (0-12 nautical miles (nm)) and the Welsh off-shore region (12-200nm). The Senedd has legislative competence, and the Welsh Ministers have regulation making powers to bring into force legislation within the Welsh Zone to support sustainable commercial fish and shellfish stocks and protect and conserve the marine environment.

The MMO has the responsibility to manage fisheries and carry out enforcement activities in English waters from 0-200 nm and leads on managing fishing activities between 6–200nm. Ten Inshore Fisheries and Conservation Authorities (IFCAs) have the power, in English waters, to deliver additional fisheries conservation and management within the inshore 0–6nm zone. The MMO has the power to make byelaws to manage fishing activity within an IFCA district, and quality assures all IFCA byelaws prior to submission to the Secretary of State.

International vs domestic policy and legislative linkages

International

- The Convention on Biological Diversity
- The UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (The 'Aarhus convention')
- The United Nations Convention on the Law of the Sea
- The Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention')
- United Nation Sustainable Development Goals
- United Nation Fish Stocks Agreement
- UK-EU Trade and Cooperation Agreement
- EU Multi Annual Plan for Western Waters

UK

- Fisheries Act 2020
    - The Sea Fisheries Regulations
- Joint Fisheries Statement
- UK Marine Policy Statement
- Marine and Coastal Access Act 2009
- Fisheries Framework Memorandum of Understanding
- The Marine Strategy Regulations 2010, Good Environmental Status and UK Marine Strategy
- Environment Act 2021
    - The Environmental Targets (Biodiversity) (England) Regulations 2023
- Wildlife and Countryside Act 1981
- Natural Environment and Rural Communities Act 2006
- Bass Nursery Area regulations

England only

- Defra 25 Year Environment Plan
- Defra Environmental Improvement Plan 2023
- IFCA byelaws (see below)
- The conservation of Habitats and Species Regulations 2017
- Marine plans in English Waters
- Statutory Instrument 2004 No. 1633: The Environmental Assessment of Plans and Programmes Regulations 2004

Wales only

- Welsh byelaws (see below)
- Well-being of Future Generations (Wales) Act 2015
- Environment (Wales) Act 2016
- Welsh National Marine plan 2019
- Assessing Welsh Fishing Activities (AWFA)-Evaluation of fishing activity interactions with features of Welsh Marine Protected Areas (MPAs)

Legislative requirements for FMPs under the Fisheries Act 2020 and Governance

Requirement of the Fisheries Act 2020	Approach in Bass FMP
Section 1 of the Act details the eight overarching Fishery	The Bass FMP establishes how the management of bass fisheries in

Requirement of the Fisheries Act 2020	Approach in Bass FMP
Objectives that guide its application and subsequent decisions made under that Act.	English waters will contribute to the delivery of these legislative objectives- each goal outlined in the FMP is mapped to the relevant Fisheries Act objective.
Section 1(3) & (10) of the Act sets out how the precautionary approach must apply, defining it as *"an approach in which the absence of sufficient scientific information is not used to justify postponing or failing to take management measures to conserve target species, associated or dependent species, non-target species or their environment".*	Bass is classified as a category 1 stock by International Council for the Exploration of the Sea (ICES). This implies it is relatively data-rich, and evidence is available to support the existing management framework. However, recognising the requirements of the precautionary objective, the Bass FMP builds on this framework to propose an adaptive and agile management approach focused on improving data collection where evidence gaps still exist. The implementation of the Bass FMP will be guided by the best available information. Even where information is uncertain or inadequate, it will still be necessary to act to deliver on management outcomes. The FMP will also allow the effectiveness of any management intervention to be monitored and reviewed, so that it can be refined if needed.
Section 2(3) of the Act states that the JFS should detail the plans that are either in force or will be prepared, the scope of each plan, the responsible body for delivering the plan and the timeframes for preparation and publication.	The JFS published in November 2022 details these requirements for the Bass FMP.
Section 2(6) of the Act explains that a "*fisheries management plan*"	This Bass FMP establishes a roadmap to ensure bass stocks in English and

Requirement of the Fisheries Act 2020	Approach in Bass FMP
means a document, prepared and published under this Act, that sets out policies designed to restore one or more stocks of sea fish to, or maintain them at, sustainable levels.”	Welsh waters can be harvested at sustainable levels.
Section 6(2) references that the plan should detail the indicator or indicators that will be used to monitor its effectiveness.	Performance indicators for monitoring the performance of this plan against desired outcomes have been outlined for each goal in the Bass FMP. In addition, a monitoring and evaluation strategy has been proposed as an initial output of the bass management group to assess effectiveness of the plan over the next six years.
Section 6(3) of the Act sets out that FMPs “*must specify whether the available scientific evidence is sufficient to enable the relevant authority or authorities to make an assessment of the stock’s maximum sustainable yield and if it is not, (I) must specify policies of the relevant authority or authorities for maintaining or increasing levels of the stock, (ii) specify the steps (if any) that the relevant authority or authorities propose to take to obtain the scientific evidence necessary to enable an assessment of the stock’s maximum sustainable yield to be made, and (iii) where no such steps are proposed, state the reasons for that.”*	The Bass FMP presents the evidence that clarifies the current data / information status of bass fisheries in English waters. Bass is categorised as a category 1 stock by ICES, meaning it is relatively data-rich, and a robust assessment of maximum sustainable yield for the stock is possible.
Section 6(5) of the Fisheries Act requires that the plan must contain a statement to the effect it has been	This FMP sets out the policies and measures to manage fishing activity within the bass fishery in English and Welsh waters. The policies and

Requirement of the Fisheries Act 2020	Approach in Bass FMP
prepared and published for the purposes of the Act.	measures contained within this plan have been prepared to meet the requirement of section 6(5) of the Fisheries Act 2020.

Bass FMP links to wider environment policies

Environmental Improvement Plan 2023 (EIP2023)

The EIP23 details the goals that government will pursue to improve the environment within a generation. It sets out how marine biodiversity will be protected and restored and how the management of fishing should take an ‘environment first’ approach. EIP23 sets out a series of ambitious targets with the following relevance to the Bass FMP:

- Ensuring that all fish stocks are recovered to and maintained at levels that can produce their maximum sustainable yield.

The Bass FMP delivers on this goal by committing to continue allocating catch in accordance with ICES scientific advice which does not exceed an MSY approach (within 95% confidence intervals) - see Goal 6. In addition, committing to improving evidence collection and filling data gaps to ensure stock assessments are as accurate as possible.

- A series of targets relating to protecting and restoring wider marine biodiversity including increasing the proportion of protected and well-managed seas, better managing existing protected sites, and ensuring populations of key species are sustainable with appropriate age structures.

The Bass FMP sets out an approach to better understand the impacts that bass fishing may have on the marine environment and to ensure action is taken when such impacts may prevent us achieving these targets (see actions outlined in Goal 8).

UK Marine Policy Statement (MPS) and individual Marine Plans in English and Welsh waters

Section 58(3) of the Marine and Coastal Access Act (2009) requires the FMP to have regard to marine plan policies and the marine policy statement. The MPS establishes the overarching framework to support the formulation of Marine Plans, to ensure marine resources are used in a sustainable way. The MPS details the objectives that will drive Marine Plans and the overarching outcomes sought. These include sustainable economic development, a low-carbon economy, a sustainable marine environment, and realising the societal benefits that the marine area can provide.

There are ten Marine Plans covering English waters and one for Wales (see above). Collectively they put into practice the objectives for the marine environment identified in the MPS. Marine Plans should provide for fishing and aquaculture use and ensure that decisions on other marine uses support habitats for fish stocks (nursery or spawning grounds).

The Bass FMP objectives align with the MPS objectives in terms of the shared ambitions to deliver:

- The bass stock harvested sustainably over the long-term and a diverse and healthy marine environment;
- Ensure bass resources are managed to deliver social and economic prosperity to coastal communities;
- Provide opportunities for stakeholders to engage in and collaborate on management decisions relating to bass; and
- Ensure decision making is underpinned by scientific and socio-economic evidence, with decisions monitored to ensure they are effective.

Measures developed under the Bass FMP should take account of the requirements of the relevant Marine Plan. Similarly, decisions on wider marine access and use made under a Marine Plan should consider the objectives of the Bass FMP. We will establish a relationship between marine spatial planning and fisheries management plans so these policies can work in a joined-up way to ensure more effective use of the marine space and resources. For future iterations of the FMP, a full Marine Plan Policy Assessment will be carried to scope-in relevant marine plan policies and describe how they have been taken into consideration.

The UK Marine Strategy (and Good Environmental Status)

The UK Marine Strategy provides the framework for delivering clean, healthy, safe, productive, and biologically diverse oceans and seas. It consists of a 3-stage framework for achieving good environmental status (GES) in our seas through protecting the marine environment, preventing its deterioration, and restoring it, where practical, while allowing sustainable use of marine resources.

The Bass FMP will continue to contribute to GES by managing fishing activity to harvest bass within sustainable limits in English and Welsh waters. This Bass FMP will seek to improve the science and evidence base on the status of bass stocks, establish the impact of bass fishing on the marine environment, and intervene to mitigate any adverse impacts. In addition, it will ensure that bass harvesting is responsibly managed so that the fisheries can deliver social and economic benefits for coastal communities.

Marine wildlife bycatch mitigation initiative

The marine wildlife bycatch mitigation initiative sets out how the UK will achieve its ambitions to minimise and, where possible, eliminate the accidental capture and entanglement of sensitive marine species in UK fisheries. The Bass FMP will contribute to the initiative by improving monitoring of bycatch, identifying, and managing (through bycatch mitigation measures) bycatch hotspots. For other actions and commitments that align with the bycatch mitigation initiative, see Goal 8.1.

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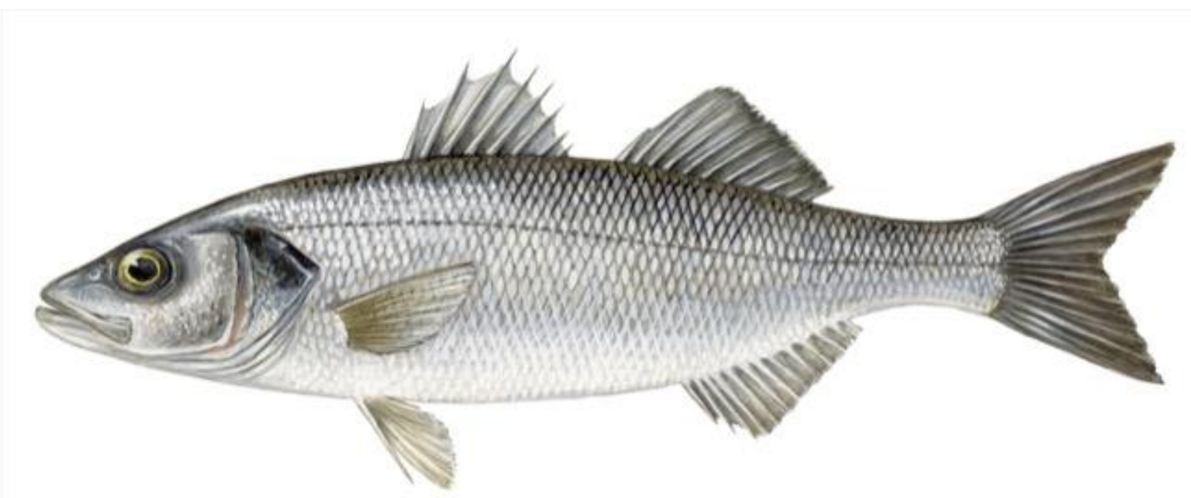

Defra and Welsh government would like to acknowledge the advice, evidence and support that has been provided by the Association of Inshore Fisheries and Conservation Authorities (AIFCAs),Cefas, Environment Agency (EA), Joint Nature Conservation Committee (JNCC), Marine Management Organisation (MMO), Natural England (NE), Natural Resources Wales (NRW), Seafish and our stakeholders, throughout the development of this FMP.

Contents

Introduction

This Evidence Statement contains evidence on the fisheries targeting and landing bass, as well as the life history and stock assessment of bass. All evidence relating to the goals of the FMP is included within Annex 10.

All of the fisheries data included within this FMP are considered to be accurate at the time of compilation, and represents the best available data at the time of drafting. Fisheries data inherently is variable due to retrospective amendments and corrections to reported data meaning revisions of a dataset may differ from another. Issues can sometimes be identified via ongoing data quality and assurance checks and retrospectively amended.

Moreover, the methods used to produce estimates are constantly being assessed, iterated, and improved meaning those figures requiring additional processing may vary slightly compared to other similar datasets depending on the methods in use. Assumptions have been made (e.g. even distribution of landings across ICES rectangles) in order to apportion the data to the FMP area resulting in uncertainty in the absolute landings figures. In addition, fluctuations between years may need to be interpreted with caution due to the uncertainties described above in the data sets.

Overview of the fishery/stock

This Bass FMP includes bass (*Dicentrarchus labrax*) only in the Northern Stock (figure 1 below) that occur in English and Welsh waters (central and southern North Sea, Irish Sea, English Channel, Bristol Channel and Celtic Sea; ICES divisions 4.b-c, 7.a and 7.d-h).

Methods

The following information is generated from the MMO and Seafish. MMO UK landings data were extracted from the Sea Fisheries Statistics Annual Publication[1]. EU landings data were extracted from 2022 DCF Fisheries Dependent Information (FDI) data call[2].

1 UK sea fisheries annual statistics report 2021 - GOV.UK (www.gov.uk)

2 Fisheries Dependent Information - European Commission (europa.eu)

Data were processed by MMO internal analysis to produce English and Welsh water estimates.

This report also includes data collected by Seafish during the Fleet Economic Surveys and is estimated based on the methodology described in the UK Economic Fleet Estimates and Fleet Enquiry Tool[3] as well as information shared with Seafish as part of Data Collection Framework by MMO. All data has been apportioned to the FMP area (English and Welsh waters) and only includes UK vessels other than if stated.

All economic data is collected and estimated by Seafish fleet segments, which group all vessels catching different species using different gears to 33 homogeneous groups. To separate economic values by FMP area and specific species individual vessel level economic performance and employment indicators were partitioned following these steps:

1. Individual vessels landings by rectangle were partitioned to FMP area based on MMO methodology published as part of the UK commercial sea fisheries landings by Exclusive Economic Zone of capture report[4].
2. The FMP stock/species economic dependency[5] for each vessel in the fleet in relevant years was calculated. The calculations are based on associated species and FMP area definition calculated as part of step 1.
3. FMP economic dependency at vessel level is multiplied by each economic variable to obtain GVA (Gross Added Value), operating profit, net profit, and FTE (full time equivalent jobs) by FMP stock/species (assumption: all stocks/species landed by vessel are contributing to the total economic results by the same share as value landed).
4. All results calculated at vessel level are summarised to FMP level.

Commercial fishing methods and geographical location

Historical bass landings in the commercial sector increased from the mid-1980’s and peaked at 4,562 tonnes in the UK in 2010, followed by a decline. Since the

3 UK Economic Fleet Estimates and Fleet Enquiry Tool - Methodology Report — Seafish

4 UK commercial sea fisheries landings by Exclusive Economic Zone of capture report 2019 - GOV.UK (www.gov.uk)

5 Economic dependency is calculated as a share of value of landings coming from the FMP stock/species to total value landed by vessel per reference year.

implementation of the new management measures in 2015, landings have remained below the MSY target and much reduced from their 2010 peak (Britton et al. 2023).

Within the FMP area bass landings by UK vessels peaked in 2014 with 987 tonnes landed at a value of over £7million, then subsequently declined to a low of 406 tonnes at a value of approximately £4million in 2019, followed by an increase in landings and value of landings in 2020 and 2021 (Fig. 1). Since 2015, the average annual value per tonne has remained consistent (Fig. 1). The live weight landed within the FMP area accounts for 98-99% of bass landings within all UK waters, with the remainder landed outside the FMP area. EU vessels also land bass within the FMP area, accounting for 48% of total landings within the FMP area between 2013-2015, followed by a stepwise decline to 28% between 2016-2017, and 16% between 2018-2021.

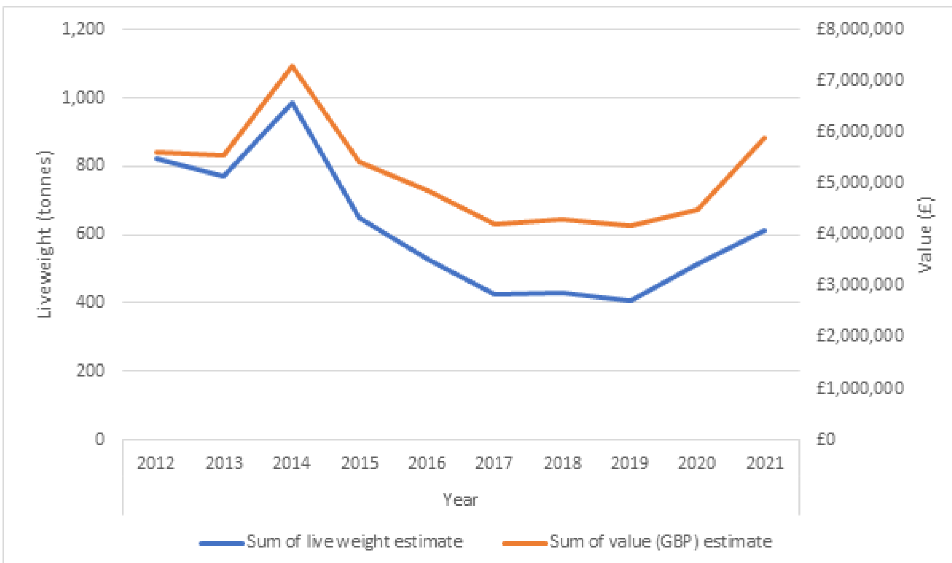

Figure 1. Liveweight and landings value of bass caught by UK vessels within the FMP area between 2012 and 2021.

Landing bass is prohibited between February and March (Section 5 of FMP). Over the past five years, bass landings have increased steadily throughout spring and summer before declining through autumn and winter months (Fig. 2). Landings value generally mirrored volume landed, with an increase in value per tonnage landed during the summer months

Figure 2. Five-year average (2017-2021) liveweight (tonnes) of bass during each month, caught by UK vessels within the FMP area. Landings are prohibited in February and March (small tonnage values (<1 tonne) are likely due to reporting error).

The number of vessels landing bass has fluctuated over the past six years, with 1005 vessels landing bass during 2016 and 870 vessels in 2021. English vessels account for most bass landings (82-90% between 2016 – 2021) with landings having reduced between 2016 and 2018 from 453 tonnes to 349 tonnes, and then increased to a peak of 509 tonnes in 2021 (Fig. 3). Welsh vessels have the second highest landings of bass in English and Welsh waters, following a similar trend of a decline in landings from 64 tonnes in 2016 to 38 tonnes in 2019, and increasing to 90 tonnes in 2021 (Fig. 3).

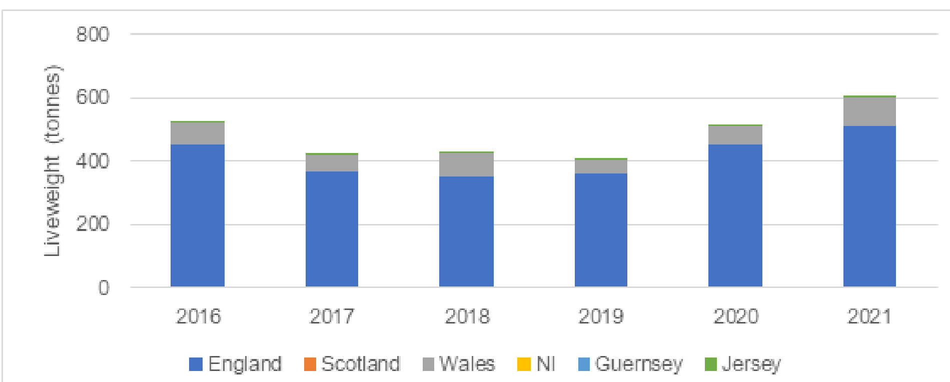

Figure 3. Liveweight of bass caught by different nationality vessels within the FMP area between 2016 and 2021.

Most vessels landing bass within the FMP area have limited dependence (<5% of their landings value) on bass. Since 2016, the number of vessels with greater than 60% economic dependence on bass landings has varied between 2-6 vessels. Most bass landings (in weight) are caught by <10m vessels (84-93%) (Fig. 4). In 2021, 69% of bass landings were from vessels in the <8m size class and 24% were in the 8-10m size class.

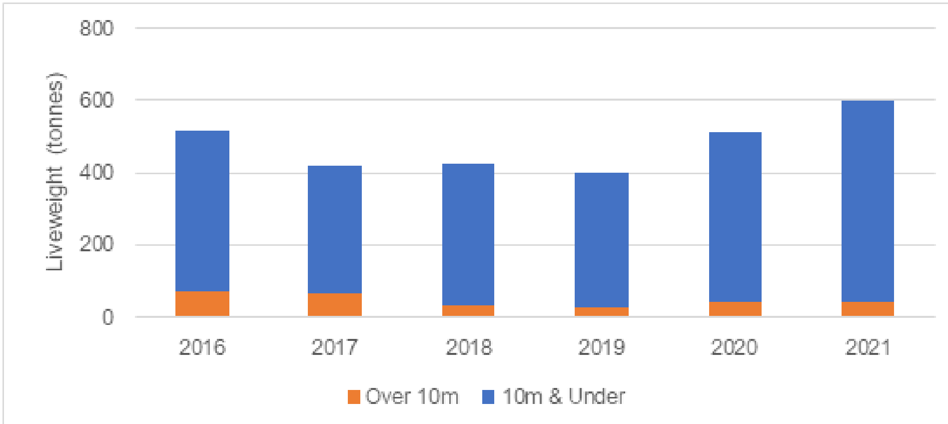

Figure 4. Liveweight of bass caught by vessels less than and greater than 10m within the FMP area between 2016 and 2021.

Of those vessels where their total income is more than 20% dependant on bass landings, over the past six years 8-9 vessels have been <10m and the number of >10m vessels has declined with 13 dependent vessels in 2016, followed by nine vessels in 2017 and 2018, seven in 2019, four in 2020 and five in 2021 (Fig. 5).

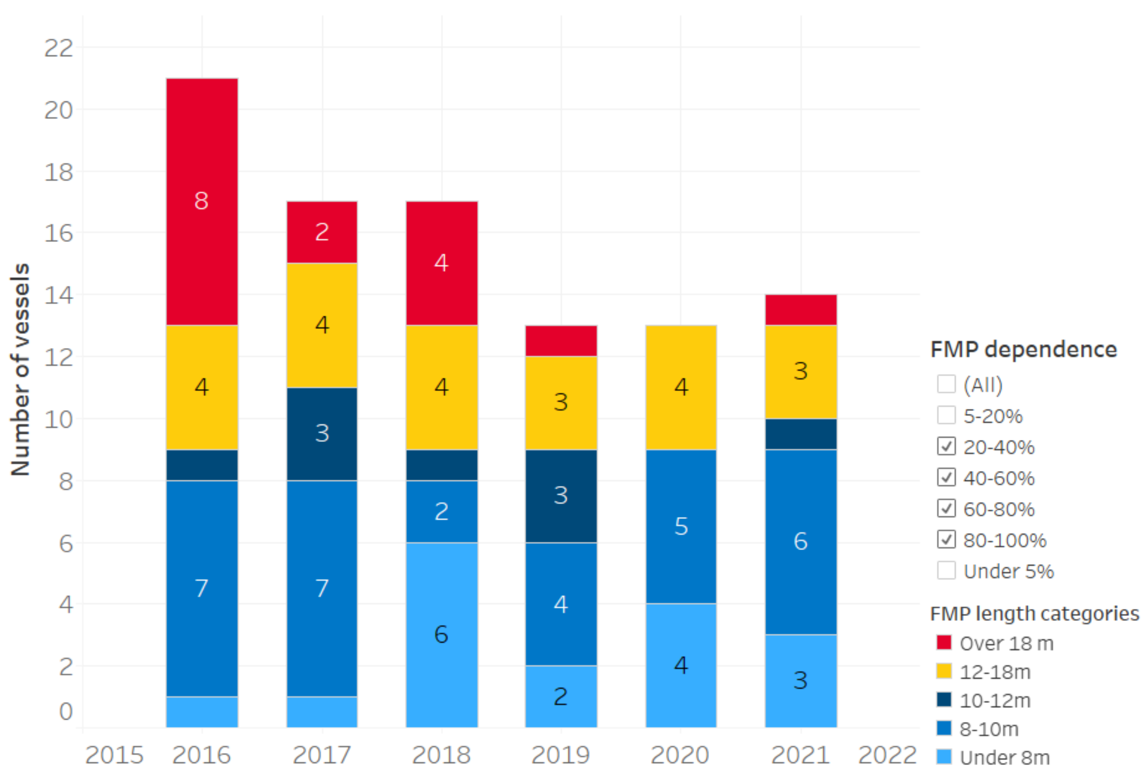

Figure 5. Number of vessels by vessel size categories that are >20% economically dependent on bass, between 2016 and 2021.

Since 2017, the predominant gear used to catch bass is hook and line, with landings ranging from 252 to 351 tonnes, and accounting for approximately two thirds (60-66%) of all landings liveweight (Table 1). In 2016, the predominant gear type was fixed nets, accounting for 51% of landings. Since 2017, fixed nets have accounted for 29-32% of landings. Demersal trawls and beam trawls are the next most common gear types, followed by demersal seines (Table 1). For English vessels the predominant gear used to catch bass is handlines (63% of landings in 2021), whereas for Welsh vessels the predominant gear type is fixed nets (66% of landings in 2021).

Bass caught using hooks and lines has on average (between 2016-2021) been landed at a higher price compared to other gear types, with a value of approximately £10,047 per tonne compared to £8,368 per tonne for bass caught using fixed nets and £7,692 per tonne for bass caught using demersal trawls.

Table 1. Landings of bass by different gear types within the FMP area between 2016 and 2021.

Gear Category	2016 (t)	2017 (t)	2018 (t)	2019 (t)	2020 (t)	2021 (t)
Hook and Line	209	252	269	256	305	358
Fixed nets	239	107	129	117	160	190
Demersal trawls	52	39	13	15	27	32
Beam trawls	11	15	11	11	14	11
Demersal seines	5	6	1	1	2	4

Since 2017, most bass landed has been caught from ICES area 7e (western English Channel), accounting for 30-44% of total landings, specifically from the southern Cornish coast (Fig. 6), followed by ICES areas 7d (eastern English Channel), accounting for 24-32% of total landings. The next most significant area for bass landings is ICES area 7f (the Bristol Channel) with 13-20% of landings, followed by ICES area 4c (the southern North Sea) with 9-12% of landings.

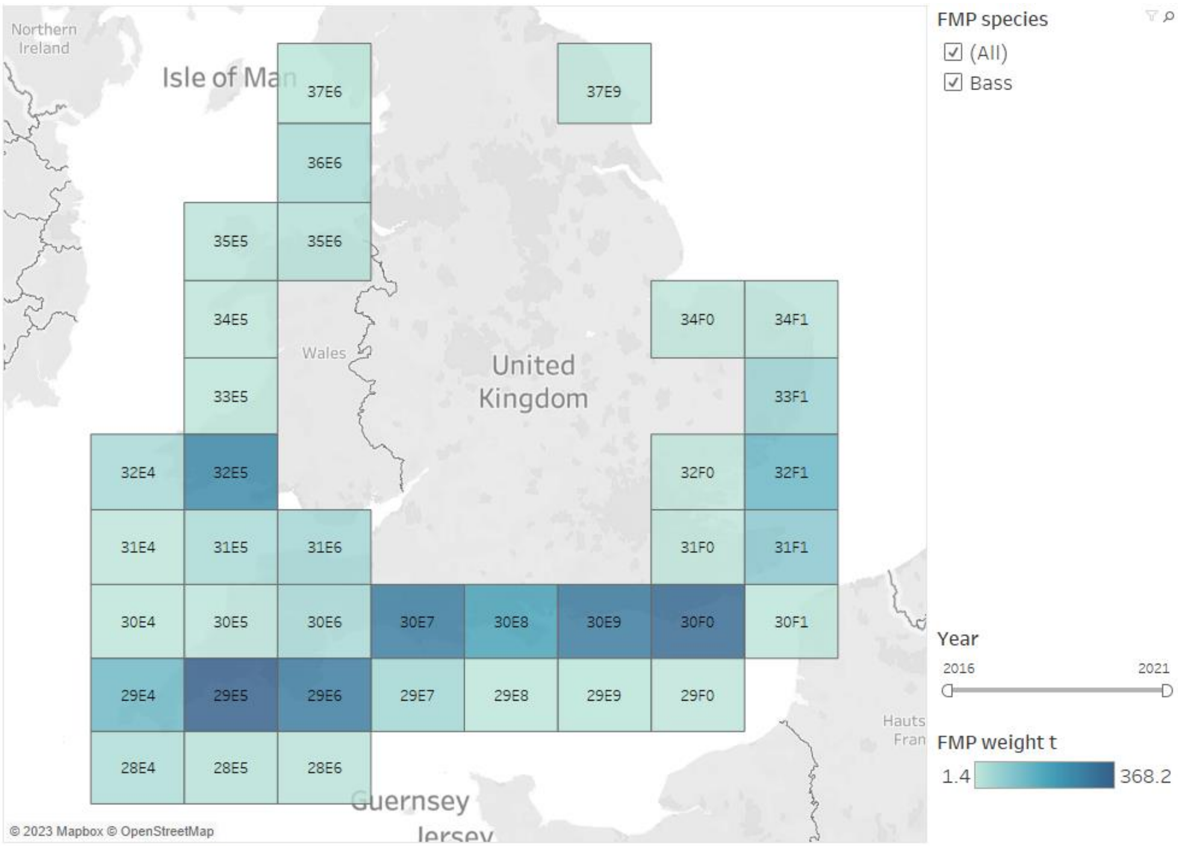

Figure 6. Spatial distribution of bass landings by UK vessels by ICES rectangle in the FMP area between 2016-2021.

Within the English Channel (ICES areas 7d and 7d), bass are predominantly caught using hook and line, whereas in the southern North Sea bass are predominantly caught using fixed nets (Fig. 7).

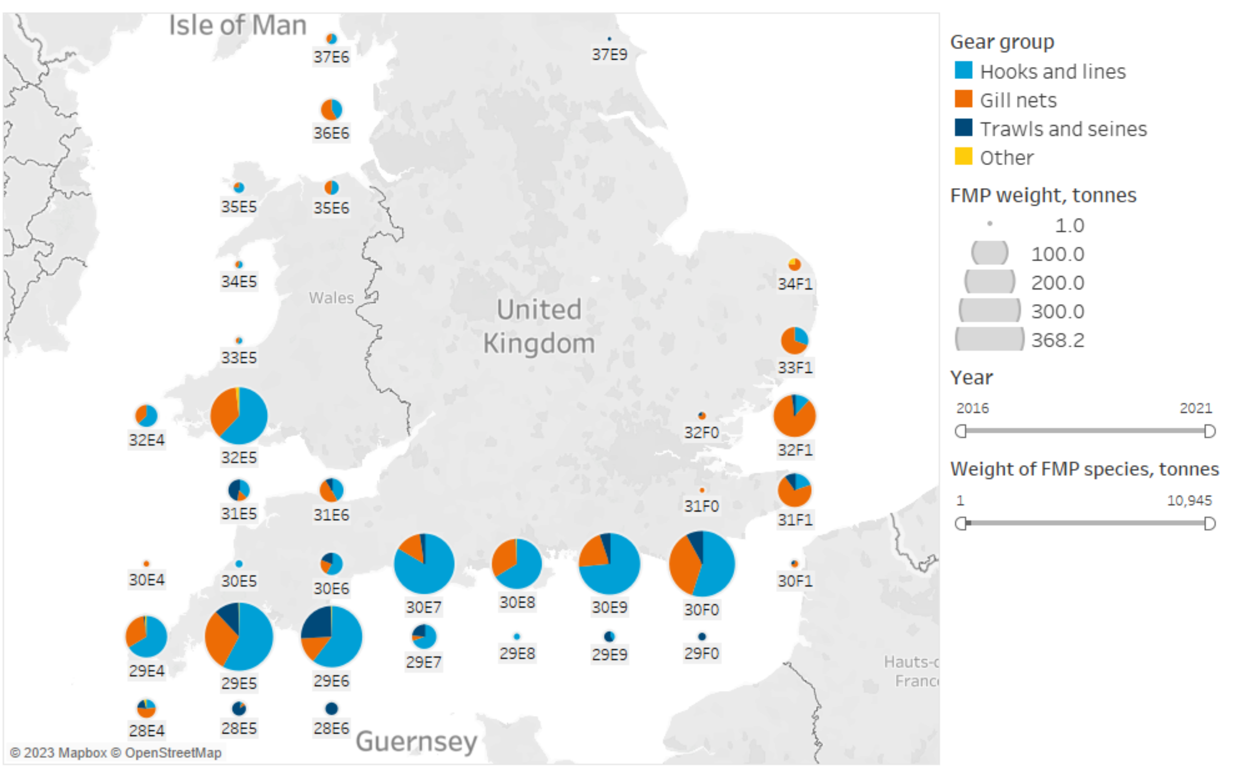

Figure 7. Spatial distribution of bass landings by UK vessels by ICES rectangle and gears used between 2016-2021.

In 2021, most bass were landed to ports in the Southwest of the UK, with four of the top five ports being Plymouth, Weymouth, Brixham and Newlyn (Fig. 8). At all ports most landings are from vessels <10m, the majority of vessels greater than 10m land to Brixham.

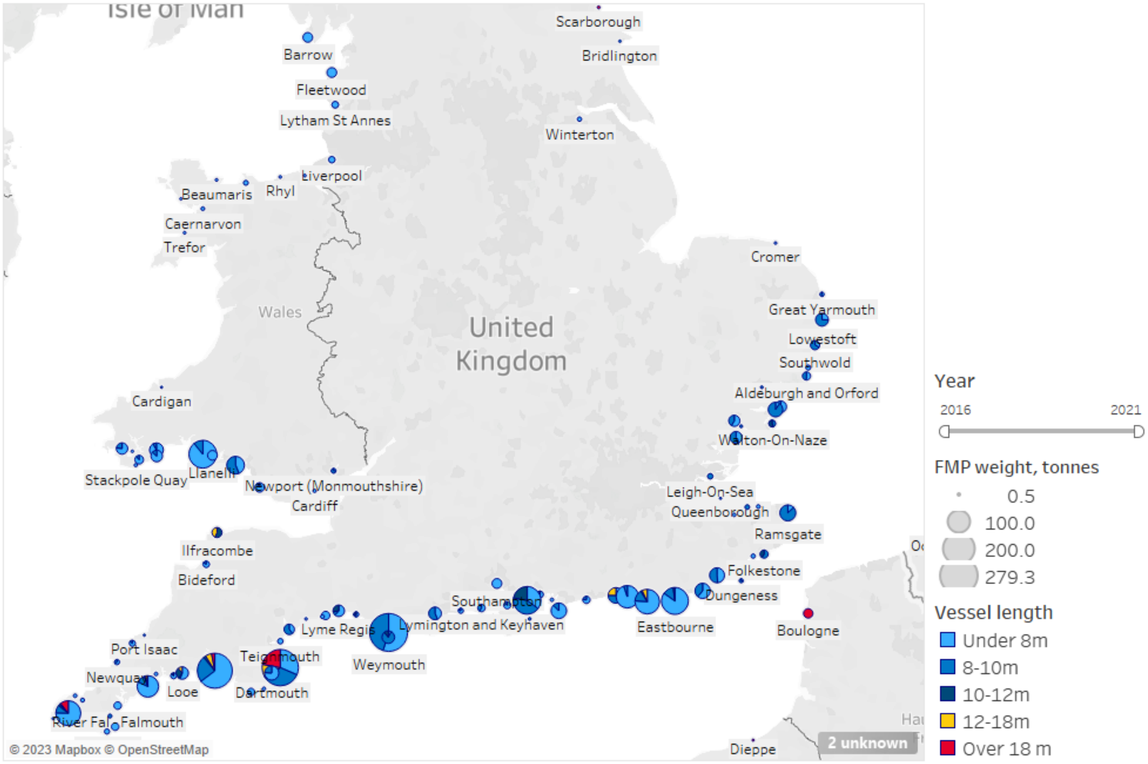

Figure 8. Spatial distribution of bass landings by UK vessels by port of landing between 2016-2021.

Economic and social data for the commercial fishery

Fishing income, GVA; a proxy value of sector contribution to gross domestic product and a measure of value created for society, net profit and operating profit have all declined from 2016 to 2021 (Fig. 9). However, landings only decreased from 2016 to 2019, and have subsequently increased (Fig. 1).

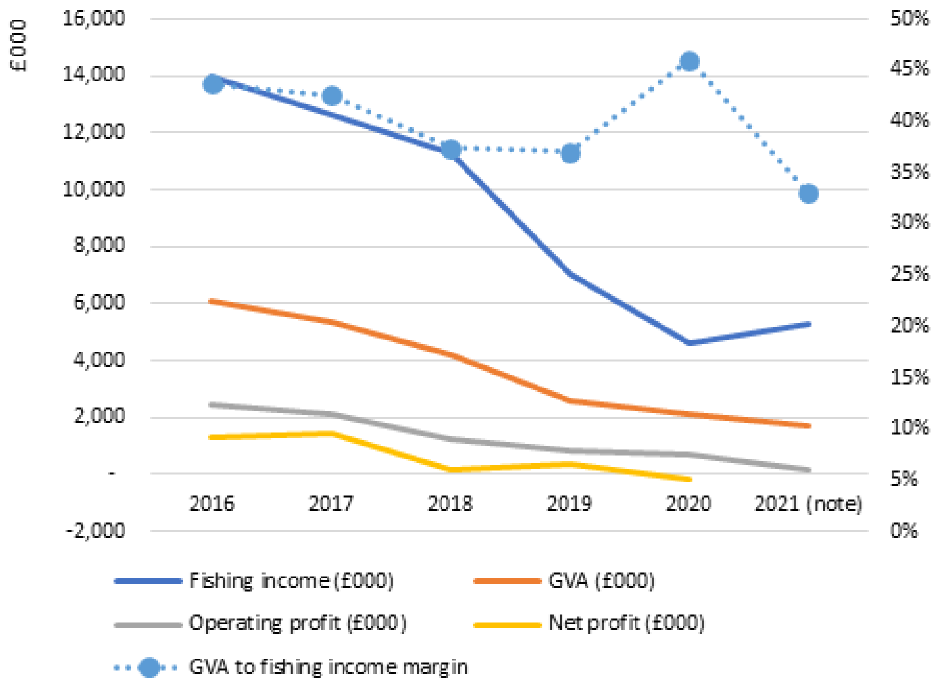

Figure 9. Economic performance indicators associated with bass landings from within the FMP area between 2016-2021.

The tonnage of bass landed and average price have a negative relationship, with a fall in tonnage leading to a rise in bass price. The average price is volatile but has largely stayed in a bound between £40/kg and £70/kg (Fig. 10).

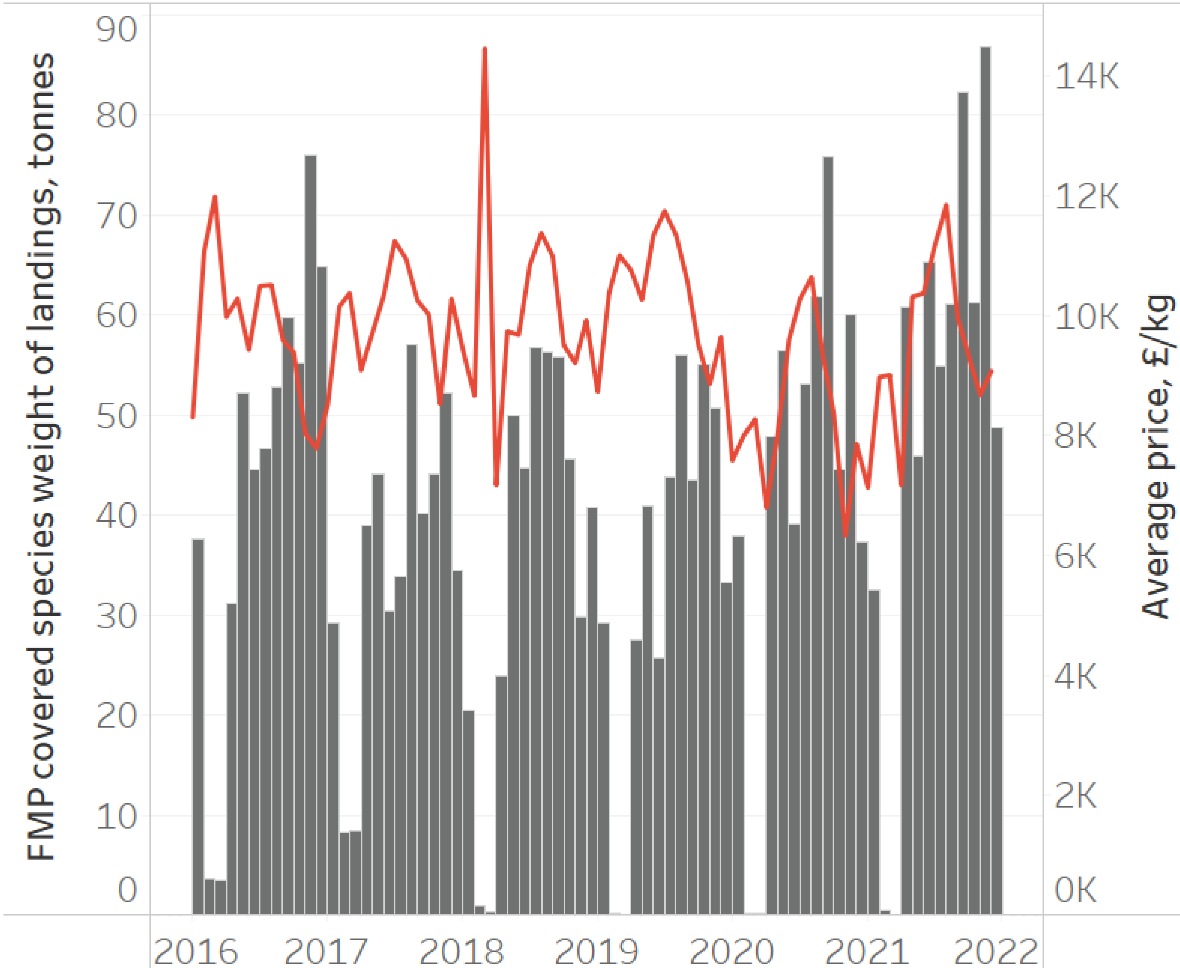

Figure 10. Bass landed (weight per month; grey bars) from within the FMP area price evolution (average price per month; red line) and seasonal fluctuations between 2016-2021.

The number of full-time employees connected to vessels catching bass has declined from 49 people to 13 from 2016 to 2020, but increased to 20 people in 2021 (Fig. 11). Most full-time employees are not working on vessels which primarily catch bass and are associated with beam trawlers and scallop dredgers, whereas most bass are caught using hook and lines and fixed nets.

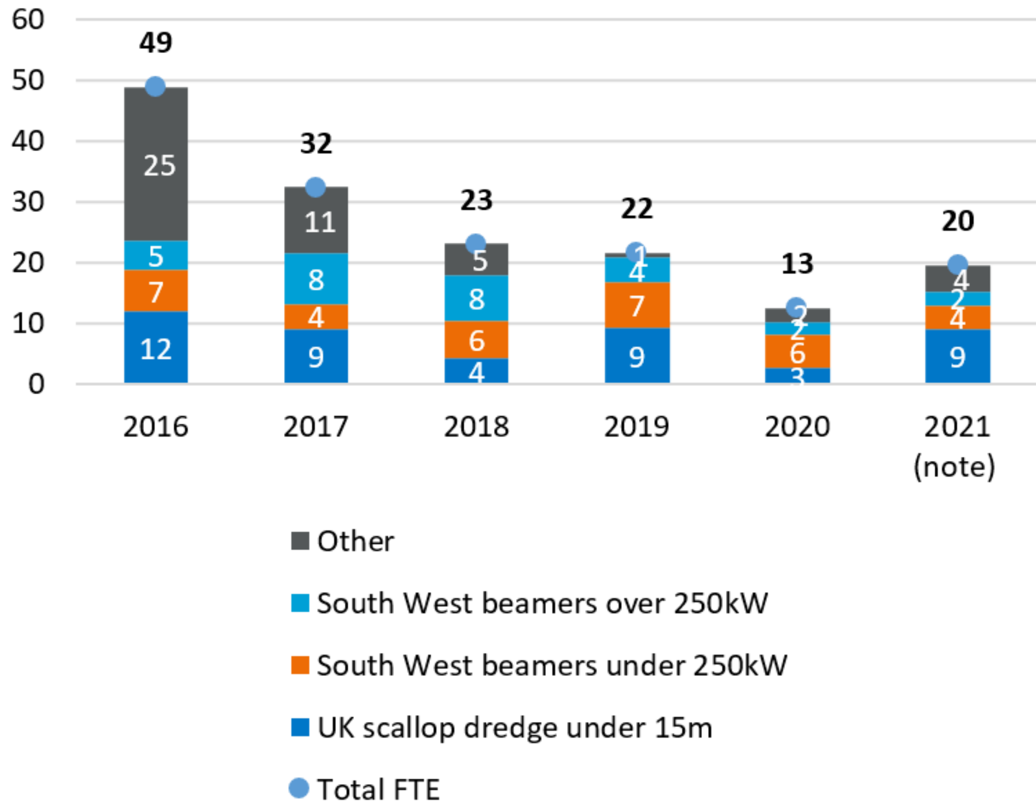

Figure 11. Employment (Full time equivalent) associated with vessels landing bass in the FMP area by Seafish fleet segments between 2016-2021, data from 2021 Employment in the UK Fishing Fleet report.

Recreational Fishing

Bass are an important target species for recreational fisheries (Armstrong et al., 2013; Hyder et al., 2020; 2021). Recreational removals (retained fish and those that die after release) for all countries exploiting the Northern stock were estimated to be in the region of 27% of the total commercial and recreational removals (Hyder et al., 2018; Radford et al., 2018) and were responsible for 489 tonnes of removals in 2021 (ICES, 2022b).

Recreational sea fishing is a high participation activity that creates economic impact and social benefits. In the UK, it is estimated that around 772,000 UK adults participated in sea angling each year between 2016 and 2019 (Hyder et al., 2021), creating a total economic impact of £1.6-1.9 billion each year (Hyder et al., 2020), with particular benefit to income in coastal communities.

Biology of the target species

Life history and distribution

European sea bass (*Dicentrarchus labrax*) is widely distributed across the northeast Atlantic (Pawson & Pickett, 1994). Bass is distributed around the UK (Fig. 12), but abundance varies between areas and seasons.

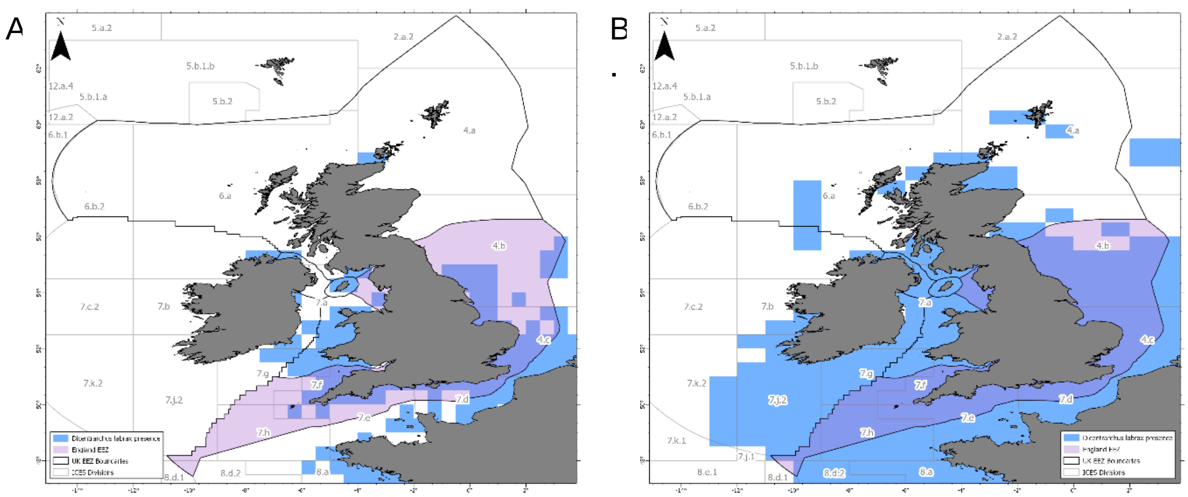

Figure 12. Recorded presence of bass around the British Isles, based on data supplied by the Ocean Biodiversity Information System (OBIS; A), and commercial fisheries landings data (B). Shaded area highlights the geographical area covered by the sea bass FMP.

Bass in the Northern stock (Fig. 14) are relatively slow growing fish that can reach up to 30 years of age and mature at around four to six years (Pawson and Pickett, 1996). Bass have a complex lifecycle with a pelagic larval phase, juveniles then occupying nursery grounds in inshore areas, before migrating out to join the adult population (Fig. 13).

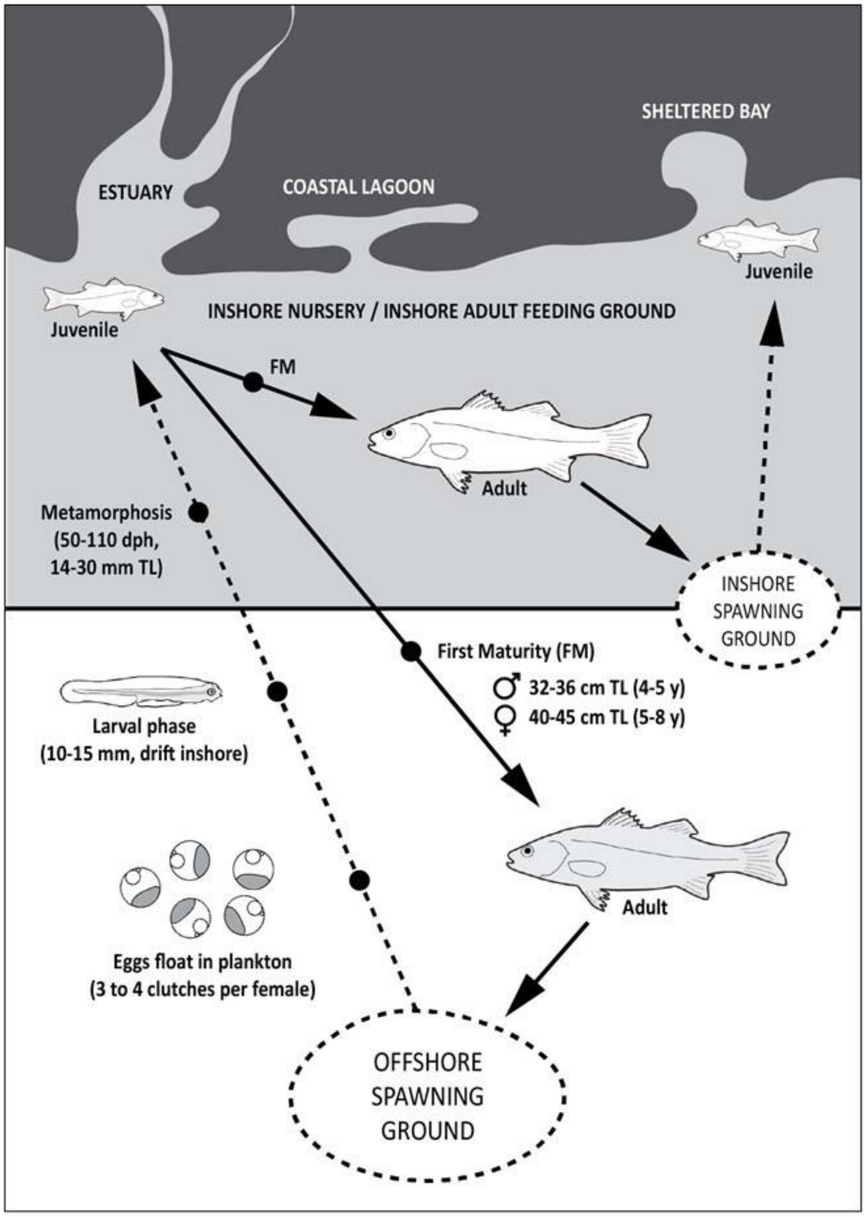

Figure 13. The life cycle of bass (Britton et al. 2023).

As adults, bass undertake seasonal migrations between inshore summer feeding areas and offshore wintering and spawning areas (de Pontual et al., 2019), with evidence of some fidelity to summer and winter regions (Pawson et al., 2008). Mature bass aggregate to spawn between January and June from the Celtic Sea to the southern North Sea (Pawson & Pickett, 1996). Bass are fractional broadcast spawners, releasing eggs and sperm into the water column, spawning three to four times in quick succession (Mayer et al., 1990). Once spawning occurs, eggs are planktonic and hatch within four to nine days before becoming larvae (Pickett & Pawson, 1994). Larvae have a pelagic stage of around 50 days and settle in estuaries, coastal lagoons, and shallow bays.

Juveniles occupy nursery areas for four to five years before joining the adult population (Pickett et al., 2004).

Juvenile bass are generalist predators consuming isopods, shrimps and with increasing length and gape size, small fishes. When compared with juvenile bass, knowledge of adult bass diet is relatively limited, but adults are thought to primarily consume small pelagic fishes, especially mackerel *Scomber scombrus*, scad *Trachurus* spp., anchovy *Engraulis encrasicolus* and sardine *Sardina pilchardus* (Spitz *et al.,* 2013).

Bass stock assessments

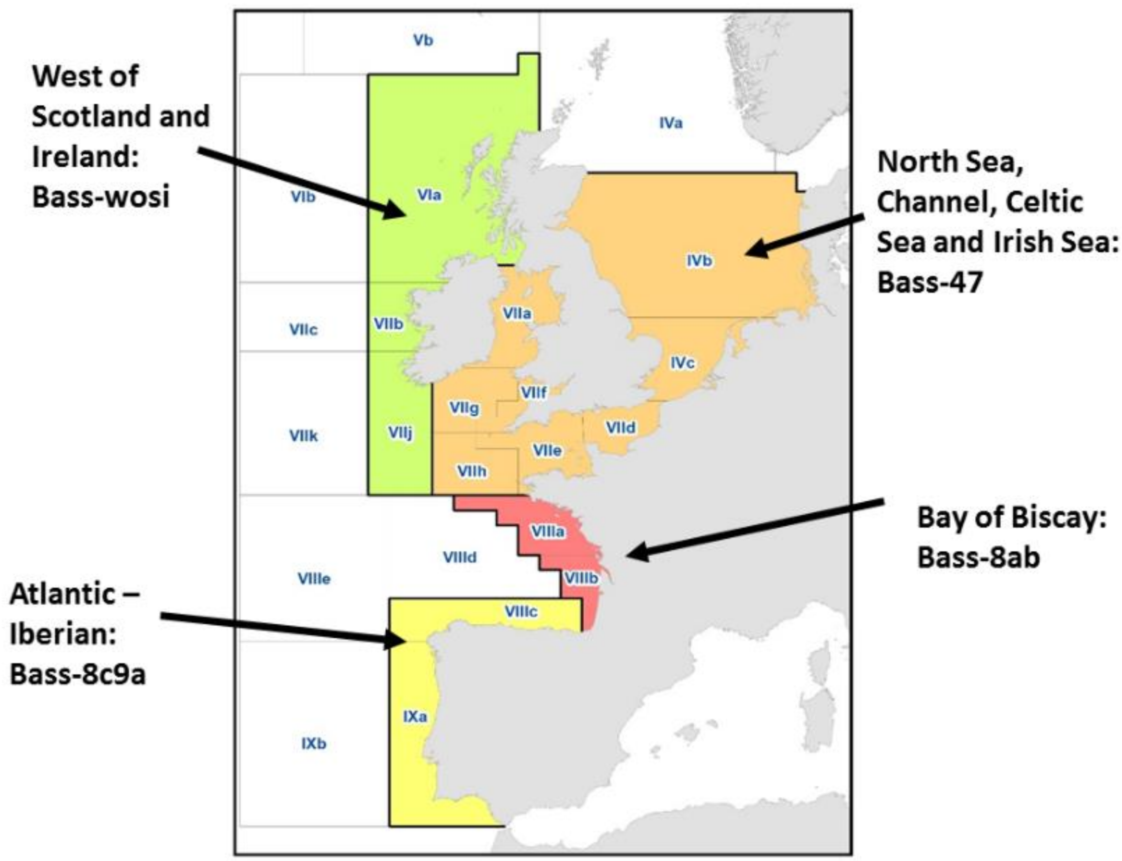

Figure 14. Currently recognised sea bass stock structures (reproduced from ICES, 2022a).

ICES currently recognise four stock units for the Atlantic. These are: Northern (central and southern North Sea, Irish Sea, English Channel, Bristol Channel and Celtic Sea; ICES divisions 4.b-c, 7.a and 7.d-h); Biscay (northern and central Bay of Biscay; ICES divisions 8.a-b); West of Scotland and Ireland (ICES divisions 6.a, 7.b, 7.j); and Atlantic Iberian (ICES divisions 8.c and 9.a) (Fig. 14, ICES, 2012a,b; 2022). The stock units were set at the last ICES benchmark in 2018 based on studies of genetics, pelagic connectivity, and adult movement (ICES, 2018). An ICES benchmark assessment for bass is being undertaken in 2023 covering both the Northern and Biscay stocks, which will review the biological relevance of the current stock structure and propose changes if needed.

Data collection to feed into stock assessments

Fisheries dependent and independent data are generated by national authorities and submitted to ICES as part of the data call for the stock assessment that covers the period from 1985 to present. Detailed descriptions of the sampling and sources are given in ICES reports (ICES 2018; 2022a).

Commercial landings data are provided by each country for the fleets modelled and sourced from the ICES Intercatch database (https://www.ices.dk/data/data-portals/Pages/InterCatch.aspx). Commercial discards data are provided from observer programmes for UK and France, and additional logbook data from 2016 onwards for France. Studies of commercial discard survival are limited, so are assumed to be zero. Commercial age and length compositions of landings and discards are collected at fleet levels by UK and France. Some biological data are also collected by the Netherlands but the sampling was too irregular at the time of the last benchmark (2018) for the data to be included in the assessment.

Recreational fisheries catches are estimated at a national level by each country. Historical recreational data are limited with catches for 2012 estimated by combining different national survey instruments (ICES, 2018; 2022a). Length composition is generated from surveys, but no age data are generated. Further surveys are underway or have been completed of recreational catches in UK, France, Belgium and Netherlands. Release rates of recreational fish can be high, so post-release mortality is important with estimates of post-release mortality included in the assessment (ICES, 2018; 2022a).

Pre-recruit surveys are ongoing in France, Ireland, and UK to generate information about year class strength. In the UK, surveys are done routinely in Solent and Fal and Helford, and historical data are available for the Thames. Young fish surveys are done by IFCAs in a number of estuaries, alongside sampling of representative catchments for the Water Framework Directive that includes sea bass. The French are collecting data from the Seine, Loire and Gironde estuaries, Douarnenez Bay, and Pertuis Charentais. Pre-recruit bass surveys are underway in four rivers in the south of Ireland, three of which are relevant for the Northern stock: New Ross Port, Slaney, and Munster Blackwater. As of 2022, only the Solent index included in the assessment.

The French Channel Groundfish Survey has been carried out in October each year since 1988. It provides swept-area indices of sea bass abundance in the Eastern Channel (7.d) together with length compositions. The majority of bass are caught in the coastal waters of England and France. Changes in vessel and gear in 2015 means that there is a discontinuity in the time-series.

In addition to regular data collection, many research projects have delivered or are underway in the UK and will provide additional information relevant to the FMP, including research on: genetics; pelagic connectivity; adult and juvenile behaviour; maturity; drivers of year-class strength; habitat use in estuaries; discards; assessment methods that account for mixing, uncertainty, and ecosystem interactions; allocation of catches between sectors; behavioural responses to management; new technologies for remote data collection onboard commercial vessels; and co-design processes.

Published assessments

ICES provides annual catch advice on fishing opportunities for the Northern stock of bass relevant to this FMP (https://www.ices.dk/advice/Pages/Latest-Advice.aspx). Full details of the assessment, input data, and other data available are provided in the annual reports of the Working Group on Celtic Sea Ecoregion (WGCSE - https://www.ices.dk/community/groups/Pages/WGcse.aspx) and associated annexes and references (ICES, 2022a).

Summary of stock assessments

The assessment model that covers the Northern stock is treated as Category 1 with a full analytical assessment and forecast (ICES, 2022a). Trends in catches, recruitment, fishing mortality, and spawning stock biomass are generated by the assessment (Fig. 15). The history of stock dynamics, as estimated in the 2022 assessment, showed that the biomass declined to 1990 due to weak year class strength, but increased markedly in the 1990s because of strong year classes particularly in 1989. The decline in spawning stock biomass from 2009 to 2018 was due to a combination of high fishing mortality and weak year class strength. The stock has been characterised by periods of poor recruitment in the 1980s and since 2008. These periods of poor recruitment have a major impact on biomass, which is exacerbated by any increase in fishing mortality. An increasing trend in biomass was estimated since 2018 which may have resulted from the management measures since 2015 alongside above average recruitment events since 2013.

A detailed short-term forecast is used to generate ICES catch advice for bass (ICES, 2022a,b). It assumes that the proportion of fishing mortality between fleets remains the same as in the last year of assessment for the intermediate and advice years.

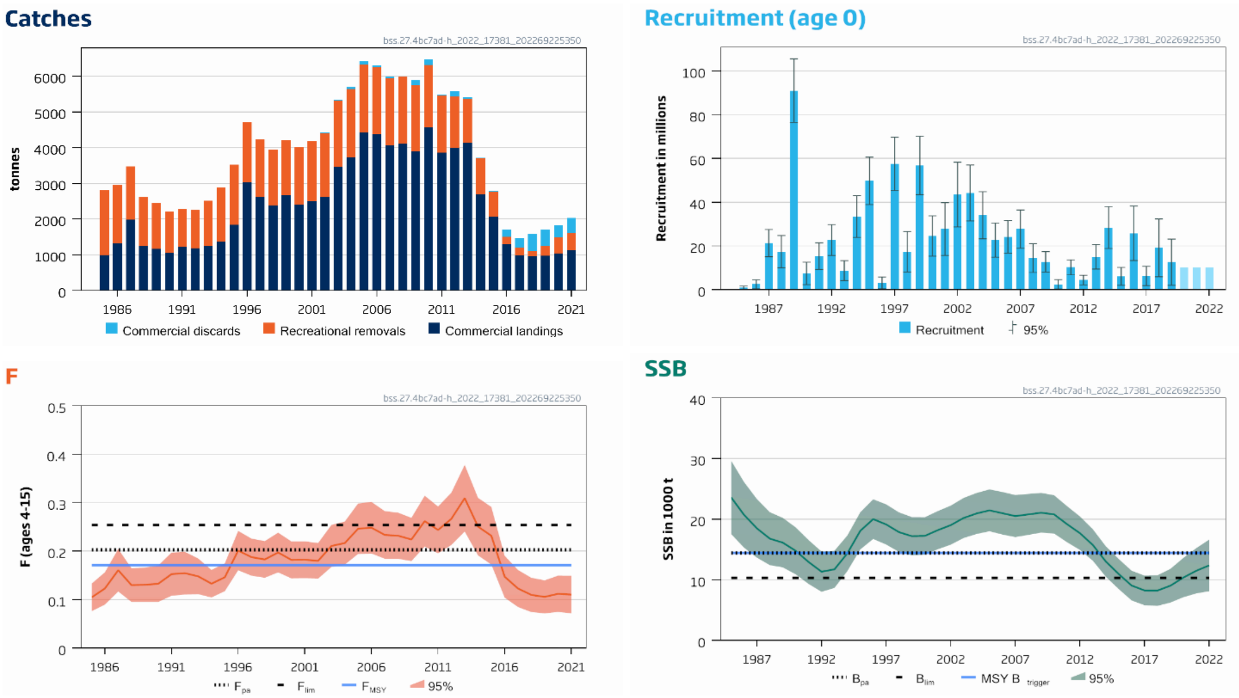

Figure 15. Sea bass in divisions 4.b–c, 7.a, and 7.d–h. Summary of the stock assessment. Recreational removals are model estimates based on a survey in 2012 and implemented management measures. Discard estimates are available since 2002. Fishing mortality (F) is shown for the combined commercial and recreational fisheries. The assumed recruitment values for 2020–2022 are shaded in a lighter colour. Reproduced from ICES (2022b).

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Research Plan

FMPs have identified evidence gaps which may need to be filled to achieve the stated FMP goals. In the short term, Defra will collate and prioritise these evidence gaps across the FMP programme, to look to deliver evidence to support in addressing some of the most pressing and key questions identified within the FMPs. However, all evidence gaps identified across the FMP programme will not be able to be funded by Defra alone. In the longer term, to support the phased approach of FMPs and progress towards meeting the Fisheries Act Objectives, Defra are developing an evidence pathway that promotes collaboration between industry, academia and fisheries managers to address these identified evidence gaps for FMPs.

Reference	Evidence gap	Actions	Progress
Goal 3. Minimise discarding of bass bycatch where survival rates are low			
3.1	Improve data on discard rates for bass (see 1.1)	Increase monitoring and data availability of bass discards using REM and other methods.	Celtic Sea REM programme underway (Cefas) on small number of otter trawls (1-3).
3.2	More information on the catch patterns of the different gear types is needed (e.g., from REM or gathering information from skippers), alongside evaluation of the implications for sea bass of new gear-based and	Increase evidence on gears and technical measures of bass fisheries.	Review of gear-based measures to modify bass catches is available.

Reference	Evidence gap	Actions	Progress
	spatial technical measures for mixed fisheries.		
3.3	Improve data on the survival of fish caught using different gears (see 2.8)	Trials of different gear modifications and best handling practice to improve survival.	Evidence on discard survival generated but based on small sample sizes.
Goal 5. Maximise the benefits of bass fishing for local coastal communities			
5.1	The social and economic importance of inshore artisanal bass fisheries, especially after the first point of sale and their overall contribution to local, regional, and national economies.	Develop an ecosystem services approach for bass.	Project underway in 2023-25 by Cefas.
5.2	Cultural values of commercial and recreational bass fisheries, and the extent to which social links between people and the sea could be affected by the decline or loss of bass fisheries.	Understand the social value of bass fisheries in coastal communities.	Project underway in 2023-25 by Cefas.

Reference	Evidence gap	Actions	Progress
5.3	Approaches to maximise the benefits to coastal communities from bass.	Understand the social value of bass fisheries in coastal communities.	Project underway in 2023-25 by Cefas.
Goal 6. Sustainable harvesting of the bass stock in line with scientific advice			
6.1.	An accurate measure of bass discard rates to feed into stock assessment models (same as 7.1)	Increase monitoring and data availability of bass discards using REM and other methods.	Celtic Sea REM programme underway (Cefas) on small number of otter trawls (1-3).
6.2.	Improved data on recreational removals to feed into stock assessment models	Increase data collection from recreational fishers.	At a UK level, the Sea Angling diary programme has provided annual estimates since 2016 (www.seaanlging.org) and an onsite survey will be generating estimates of recreational catches in 2023-24.
6.3.	A better understanding of stock mixing, and the impacts to stock assessment models	Genetics work and stock delineation assessment to determine bass stock structure.	Project completed by Cefas in 2023. ICES Bass Benchmark process in 2023-24.
6.4.	An understanding of the benefits and limitations of different management approaches that prioritise societal and ecosystem benefits	Management strategy evaluation to assess the feasibility of testing a number of management strategy scenarios.	Project underway in 2023-25 by Cefas.

Reference	Evidence gap	Actions	Progress
		Increase understanding of interactions between bass and other fish species and fisheries.	
6.5.	The role of recruitment and year class strength on spawning stock biomass recovery versus different management actions	Understanding the drivers of year class strength.	Cefas manuscript in review on drivers of year class strength.
6.6.	A fishery independent survey of the stock and distribution of adults over time.	Design and implement a bass specific survey, or look to expand the scope of existing surveys.	
Goal 7. Ongoing protection of the juvenile and spawning bass stock			
7.1	Understand the extent of philopatry in adults to specific spawning areas and the processes involved in this philopatry	Assess fine scale structure and fidelity to spawning and feeding areas using isotopes and microchemistry.	Project underway in 2023 by Cefas to start considering this question.

Reference	Evidence gap	Actions	Progress
7.2	Understand the larval dispersal dynamics and mixing events and the extent to which post-larval settlement into specific nursery areas is driven by spawning in different spatial areas	Assess linkages between spawning areas in Biscay and nursery areas of the northern stock. Assess linkages between spawning areas within the northern stock region and nursery areas of the northern stock.	Pelagic connectivity work underway by Cefas.
7.3	Understand the relative contribution of individual nursery areas to the stock	Quantify the proportion of different nursery ground signatures in different adult populations using a range of techniques.	
7.4	Understand the relationship between environmental factors on the recruitment of		

Reference	Evidence gap	Actions	Progress
	juveniles to the bass stock (see 1.5)		
7.5	Quantify whether differences occur between regional spawning periods, and the impacts on the population.	Assess spawning timing of bass in a range of locations around the UK.	Initial project completed by Cefas in 2022 (Bradley et al. 2022)
7.6	Understand the regional and interannual variations in bass abundance in nursery areas	Investigate habitat use and fine-scale population structure of juvenile seabass.	PhD project underway to understand juvenile habitats and requirements – University of Plymouth & Cefas.
7.7	Better quantify the benefits and limitations of different size management measures	Develop modelling approaches appropriate to test different size management measures.	
7.8	Understand the potential to improve selectivity and survivability from different gears	Trials of different gear modifications and best handling practice to improve survival.	
Goal 8. Minimise the impact of bass fishing on the wider marine ecosystem			

Reference	Evidence gap	Actions	Progress
8.1	Quantify the bycatch risk of bass fisheries to salmon and interactions between salmon and bass fisheries.	Bycatch monitoring. Tagging studies.	Since 2005, under the bycatch monitoring programme (BMP) observers have recorded incidences of salmon bycatch but there is not enough data to enable an analysis of bycatch estimates. The BMP was design initially to monitor bycatch incidences in small cetaceans however it is anticipated that the included fisheries and geographical scope will expand under the current contract.
8.2	Quantify the bycatch risk of bass fisheries to elasmobranch	Bycatch monitoring.	The current BMP is considering ways of expanding the geographical scope, fisheries and species to provide bycatch estimates. Since 2005 observers have recorded bycatch incidences and it has been investigated whether there is sufficient data to provide bycatch estimates. Clean Catch UK and Insight360 are developing sensitive species bycatch monitoring tools and mitigation methods. This could provide information on the interactions between bass and elasmobranch. Initial scoping work into the development of regional bycatch risk prioritisation frameworks. These hopefully will provide more granular detail of the fishery.
8.3	Quantify the spatial scale of the bass fishery, to get a better understanding of	Define bass fisheries.	The BMP has been providing bycatch estimates for marine mammals and recently bycatch estimate for

Reference	Evidence gap	Actions	Progress
	the bycatch risk to seabirds and marine mammals	Formalise linkages between relevant marine and fisheries projects through the FMP. Implementation of the Bycatch Mitigation Initiative	seabirds. The current BMP is evolving to increase and diversify monitoring. CleanCatch UK and Insight360 are developing sensitive species bycatch monitoring tools and mitigation methods. This could provide information on the interactions between bass and sensitive species. Seabird bycatch Plan of Action (now part of Clean Catch UK) provided bycatch estimates for 3 fisheries (static nets, midwater trawls and longlines) and have provide population impact through bycatch (ME6024). Initial scoping work into the development of regional bycatch risk prioritisation frameworks. These hopefully will provide more granular detail of the fishery.
8.4	Improved monitoring and reporting regimes to allow greater confidence in bycatch risk estimates	Define bass fisheries. Formalise linkages between relevant marine and fisheries projects through FMP.	The BMP has been providing bycatch estimates for marine mammals and recently bycatch estimate for seabirds. The current BMP is evolving to increase and diversify monitoring. CleanCatch UK and Insight360 are developing sensitive species bycatch monitoring tools and mitigation methods.

Reference	Evidence gap	Actions	Progress
		Implementation of the Bycatch Mitigation Initiative.	This could provide information on the interactions between bass and sensitive species. Seabird bycatch Plan of Action (now part of Clean Catch UK) provided bycatch estimates for 3 fisheries (static nets, midwater trawls and longlines) and have provide population impact through bycatch (ME6024). Initial scoping work into the development of regional bycatch risk prioritisation frameworks. These hopefully will provide more granular detail of the fishery.
8.5	Understanding the effective and practical bycatch mitigation method for sensitive species in bass fisheries.	Define bass fisheries. Formalise linkages between relevant marine and fisheries projects through FMP. Implementation of the Bycatch Mitigation Initiative.	The BMP has been providing bycatch estimates for marine mammals and recently bycatch estimate for seabirds. The current BMP is evolving to increase and diversify monitoring. CleanCatch UK and Insight360 are developing sensitive species bycatch monitoring tools and mitigation methods. This could provide information on the interactions between bass and sensitive species. Seabird bycatch Plan of Action (now part of Clean Catch UK) provided bycatch estimates for 3 fisheries (static

Reference	Evidence gap	Actions	Progress
			nets, midwater trawls and longlines) and have provide population impact through bycatch (ME6024). Initial scoping work into the development of regional bycatch risk prioritisation frameworks. These hopefully will provide more granular detail of the fishery.
Goal 9. Mitigate against and adapt to the impact of climate change on bass fishing			
9.1	The impact of climate change on northern bass stocks, including on their growth, body sizes and condition, distribution, abundance, and capture vulnerability.	Develop models to predict the impact of climate change on bass populations.	Marine Climate Change Impact Partnership (MCCIP) adaptation project on fish, fisheries and aquaculture underway.
9.2	The impact of climate change on the bass fishery.	Assess the risk and adaptive capacity of the bass fishery.	MCCIP adaptation project on fish, fisheries and aquaculture underway. Seafish Climate Change Adaptation in Wild Capture Seafood Report in process of being updated.

Reference	Evidence gap	Actions	Progress
9.3	Calculate the carbon footprint (both commercial and recreational) of the bass fishery and assess how it could be reduced	Quantify fuel usage by fishing vessels targeting and landing bass Determine interim carbon mitigating solutions for UK fishing vessels Determine long term carbon mitigating solutions for UK fishing vessels	Improved fuel use calculations by Seafish underway for the UK fishing fleet. Review planned on range of available market ready interim solutions to reduce fuel use and carbon emissions. Carbon abatement potential and cost benefit analysis of different carbon mitigating solutions for UK fishing vessels projects complete.

FINAL REPORT

Review and synthesis of current evidence on the biology, ecology and fisheries for sea bass and assessment of evidence gaps

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EXECUTIVE SUMMARY

Sea bass *Dicentrarchus labrax* ('bass' hereafter) stocks are of high socioeconomic importance to inshore fishers and recreational anglers in the UK. A combination of high fishing mortality and weak recruitment resulted in bass stock declines from 2010, with new management measures implemented in 2015 at the international level to promote stock recovery. Bass spawning stock biomass has shown some signs of recovery but remains below the MSY objective.

The UK exit from the European Union (EU) provides the opportunity to develop a bass Fisheries Management Plan (FMP) through the Fisheries Act (2020), where FMPs aim to deliver sustainable management of UK fisheries. The bass FMP will focus on the Northern stock (ICES Divisions 4.b-c, 7.a and 7.d-h). As FMPs need to be developed on an evidence basis, then this review synthesises the current state of evidence on bass stocks - primarily the Northern stock - and identifies the further knowledge needed to produce a more robust evidence-base.

The review syntheses were based on a systematic literature review of each topic. The systematic reviews provided strong coverage on topics relating to bass biology and ecology. However, they lacked information on many aspects of their fisheries, where information was more available from grey literature published by organisations including the International Council for the Exploration of the Sea (ICES; e.g. stock assessment reports).

The review syntheses indicated that bass is a relatively slow growing, omnivorous fish that generally reaches maximum lengths of 80 to 90 cm. Their populations are encountered in most estuarine and inshore areas of England and Wales through summer months, where post-larval settlement in inshore areas generally occurs from May. Juvenile bass remain in their inshore nursery grounds for several years, where estuarine saltmarsh habitats comprise important foraging sites. Adults make long distance migrations for spawning which generally occurs between February and May, with many of the post-spawned fish then returning to inshore areas close to their former nursery grounds in summer.

Inshore bass stocks are exploited by both inshore commercial fishers and recreational anglers, with these fisheries generally being seasonal (spring to autumn). Once bass reach sexual maturity, spawning generally occurs in offshore areas during spring, with the potential for mixing of fish from across their Atlantic range. Population mixing is also possible during the subsequent pelagic larval phase. This potential larval and adult mixing could be driving panmixia in Atlantic stocks, as there is little evidence of strong genetic structuring.

The Spawning Stock Biomass (SSB) of bass was relatively high through the 2000s due to the strong recruitment of the late 1980s and 1990s, with the high biomass increasingly exploited by inshore fisheries that developed new markets based on selling a high-quality product that, even today, attracts relatively high prices at the first point of sale. However, the interaction of weak recruitment and increasing fishing mortality has resulted in stock biomass declines from 2010, with levels today still depressed - despite the 2015 management measures - due to recruitment success still being relatively weak.

The relationship between bass SSB and recruitment is weak, with recruitment success being largely environmentally driven (especially by temperature). A recovery of the Northern bass stock to higher spawning biomass is, thus, largely dependent on future conditions interacting to enable the

production of a series of relatively strong year classes from a mature stock that has not been compromised by excessive fishing mortality.

The management of bass stocks thus involves regulating levels of fishing mortality from the commercial and recreational sectors to ensure that SSB levels are not reduced to unsustainable levels by fishing. This currently includes a period of no landings, this is currently February and March, while the bass spawning period in its Northern stock extends to at least May. The International Council for the Exploration of the Sea (ICES) currently undertake annual stock assessment exercises for bass in the Northern stock, with outputs then used to produce fishing opportunity advice on which management measures are set following consultation between the European Commission and UK. These assessments use model predictions based on data on fish landings and discards from fleets, and from population dynamics of bass from fishery dependent and independent sources. Additional models have been developed for research purposes (e.g. Individual Based Models) that can be used to simulate the consequences of different management scenarios for future stock levels.

This evidence review revealed that many aspects of bass biology, ecology and fisheries have a strong basis, with low uncertainty in the extent of the knowledge base (e.g. bass life cycle, life history traits including spawning times, predator-prey interactions). However, gap analyses indicated a series of evidence areas that remain deficient. In particular, substantial knowledge gaps were identified in: the socio-economic importance of inshore fisheries (especially beyond the first point of sale) and how the socioeconomics of the fisheries are affected by management changes; actual recreational angler removal rates and their role in stock decline; the role of larval mixing and adult spawning migrations in driving population structure/panmixia; and climate change impacts on bass distribution, abundance and predicted fish catches in future.

Thus, for robust fisheries management of bass stocks in future, it is recommended that these evidence gaps are at least partially overcome to remove some of the uncertainty in knowledge that forms the basis of the FMP.

CONTENTS

1. BACKGROUND

Stocks of sea bass *Dicentrarchus labrax* ('bass' hereafter) in UK waters are of high socioeconomic importance to inshore fishers and recreational anglers, and thus coastal communities more generally. Following an increase in fishing effort in the 1980s and 1990s and the development of associated markets, the combination of high fishing mortality and weak recruitment resulted in stock decline to the point where new management measures had to be implemented in 2015. Despite these measures, bass spawning stock biomass has remained low, resulting in an overall slow rate of stock recovery.

With the Fisheries Act of 2020 providing the legislative framework for the sustainable management of UK domestic fish stocks, the delivery of sustainable fisheries management will be through Fisheries Management Plans (FMPs). These FMPs are due to be developed, where the bass FMP has been prioritised for development, with future management approaches being co-designed with stakeholders. As the bass FMP will set the direction of sea bass management in the UK then it is necessary to understand the current state of existing evidence and knowledge gaps on the species and their stocks. In that regard, the bass FMP will primarily focus on the Northern stock of bass (those in divisions 4.b-c, 7.a and 7.d-h of the International Council for the Exploration of the Sea (ICES); Sections 3.1 and 4.1).

The aim of this review is to thus synthesise the current state of evidence on bass stocks (with a focus on the Northern stock) and identify what further knowledge needs to be generated for producing a robust evidence-base to support their FMP and future management. Accordingly, this report is based on systematic review, with specific search strings used to search the peer-review literature. These reviews were then complemented with the collation of grey literature (e.g. unpublished reports by government agencies, outputs of the International Council for the Exploration of the Sea (ICES)). In combination, these enabled review syntheses to be completed on a range of biological, ecological and fisheries topics, which are presented herein. The scope of the review is thus:

(i) Bass ecology and biology

- Life history and life history traits
- Recruitment and year class strengths
- Movements and behaviour of juveniles and adults, including mixing during pelagic drift
- Regional and seasonal variation in spawning
- Stock structure (e.g. genetics, isotope/microchemical analyses)
- Abundance and distribution of bass, by life history stage
- Essential fish habitat (e.g. spawning, feeding, nursery, and overwintering grounds) and its use
- Ecological interactions with other species, including predator-prey relationships
- Impact of climate change and longer-term changes in distribution.

(ii) Fisheries

- Commercial and recreational fisheries catches: landings, discards and discard survival
- Assessment of stocks
- Complementary modelling approaches
- Methods of allocating fishing opportunities
- Regional importance of sea bass fisheries relative to broader fishing opportunities
- Economic and social impacts of fisheries and management measures

The report is thus presented in four parts:

1. Systematic review: Searches and results (Section 2)
2. Review of bass ecology and biology (Section 3)
3. Review of bass fisheries (Section 4)
4. Gap analysis, summary and recommendations (Sections 5 and 6)

2. SYSTEMATIC REVIEW: SEARCHES AND RESULTS

For the purposes of the systematic literature review, the search strings used for each topic are presented in Table 2.1. These search strings were used to undertake advanced searches in January and February 2023 in:

- Web of Science (WoS): http://www.webofscience.com/
- Scopus: http://www.scopus.com/

Given the large number of hits these search terms often generated (especially in topics relating to bass ecology and biology), the initial searches were filtered manually by title to remove those that were irrelevant to the review. The searches were then combined to provide one overall search (i.e. duplicates were removed). Filtering on abstract was then used to provide a final list of literature for the topic synthesis. In general, literature relating to bass aquaculture was excluded, although some aquaculture studies were retained where it was thought there was relevance to the topic.

A summary of the search strings used, along with the initial article hit number, the number of unique hits (removing duplicates between WoS and Scopus) and the number of relevant articles retained and used in each topic is provided in Table 2.1.

It is acknowledged that while such a systematic approach enables searches to be repeated in future, some selected literature might still contain articles of relatively low relevance to the review topic and, given the specific nature of the search strings, might still miss some key articles. Correspondingly, these searches were complemented by additional non-systematic searches in Google Scholar (www.scholar.google.com) and, during the review of each article, some cited articles were discovered that had not been picked up by any other searches, and used accordingly.

There is also a large volume of grey literature on bass that was not detected in any of the searches outlined above, which primarily relate to their fisheries and associated stock assessment and structure. This was important, as the initial systematic literature searches found substantially fewer studies on fisheries topics than for bass biology and ecology to the point where these searches were discontinued, and mainly focused on the use of the grey literature, and complemented with the peer-review literature available. These grey literature studies were produced primarily by ICES that, alongside a series of government, academic and non-governmental organisations, have produced many relevant reports on work that have not always been published in full in the peer-review literature. These aspects of the grey literature were mainly sourced from:

- ICES: https://ices-library.figshare.com/
- Cefas: https://www.gov.uk

Correspondingly, in reporting the results of the systematic review process, the focus is on topics relating to bass ecology and biology, where Table 2.1 summarises the total number of hits per search term and how these were reduced by the filtering processes used. Appendices 1.1 to 1.9 then provide these results in detail in MS Excel files, where worksheets provide an overview of the results (e.g. titles of all searched articles, titles of retained articles, etc.). These files also provide the final list of retained articles, indicate whether they were then cited in the review syntheses (Sections 3 and 4), and with a final worksheet that lists the additional articles used in these syntheses that were sourced by the non-systematic process outlined above. Note that these additional articles do not include grey literature sourced from ICES and Cefas.

Finally, it is acknowledged that there are also data sources on bass stocks gained from surveys completed in inshore areas of the UK (e.g. by Inshore Fisheries and Conservation Authorities, IFCAs). Information on bass sport fisheries and some landing data are also available from the Bass Sport Anglers Association (https://www.ukbass.com). While it was beyond the scope of this evidence review to collate and analyses data held by IFCAs and the other organisations, these data sources are summarised in Appendix 2.

Table 2.1. Summary of the search strings used, along with the number of relevant articles retained and used in each topic. Searches were all completed by 28/02/2023. 'Second round results' include articles found in other thematic searches that could be integrated into the current theme.

Topic	Report section(s)	WoS search string and initial article hit number (n)	Scopus search string and initial article hit number (n)	Total article hits	Excluded - title	Excluded - duplicate	Excluded - abstract	Retained articles
Stock structure (Appendix 1)	3.6	TS = (Dicentrarchus OR labrax) AND TS = (stock structure* OR genetics* OR microchemistry* OR stable isotope* OR microstructure OR micro-chemistry OR micro-structure) Results = 208 Second round results = 18	TITLE-ABS-KEY (dicentrarchus OR labrax) AND ALL (stock AND structure* OR genetics* OR microchemistry* OR stable AND isotope* OR microstructure OR micro-chemistry OR micro-structure) Results = 38 Second round results = 29	293	164	40	41	48
Life history (Appendix 2)	3.2	TS = (Dicentrarchus OR labrax) AND TS = ("life history trait*" OR growth* OR somatic* OR "population dynamic*" OR fecund* OR mortality) NOT TS= (aquacult*) NOT TS= (gene OR brain OR cell) Results = 449 Second round results = 23	TITLE-ABS-KEY (dicentrarchus OR labrax) AND ALL ("life history trait*" OR growth* OR somatic* OR fecund* OR mortality) AND NOT (aquacult*) AND NOT (brain OR gene) Results = 222 Second round results = 21	715	407	74	174	60
Mixing due to pelagic drift (Appendix 3)	3.6	TS = (Dicentrarchus OR labrax) AND TS = (population mix* OR drift OR pelagic drift) Results = 57 Second round results = 18	TITLE-ABS-KEY (Dicentrarchus OR labrax) AND ALL ("population mix*" OR drift OR "pelagic drift") Results = 24 Second round results = 29	128	40	25	39	24

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Topic	Report section(s)	WoS search string and initial article hit number (n)	Scopus search string and initial article hit number (n)	Total article hits	Excluded - title	Excluded - duplicate	Excluded - abstract	Retained articles
Movements and behaviours (Appendix 4)	3.4	TS = (Dicentrarchus OR labrax) AND TS = (vagility OR mov* OR migrat* OR track* OR telemetry* OR behave* OR distribut* OR spatial* OR migrat*) NOT TS = (aquacult* OR gene OR brain OR cell) Results = 487 Second round results = 13	TITLE-ABS-KEY (dicentrarchus OR labrax) AND ALL (vagility OR mov* OR migrat* OR track* OR telemetry* OR behave* OR distribut* OR spatial*) AND NOT ALL (aquacult* OR gene OR brain OR cell) Results = 215 Second round results = 19	734	494	102	111	27
Abundance and distribution (Appendix 5)	3.7	TS = (Dicentrarchus OR labrax) AND TS = (abund* OR distrib*) AND TS = (life-stage OR larv* OR juv* OR adult OR mature) NOT TS= (gene OR brain OR cell) Results = 231 Second round results = 15	TITLE-ABS-KEY (dicentrarchus OR labrax) AND TITLE-ABS-KEY (abund* OR distrib*) AND ALL (life-stage OR larv* OR juv* OR adult OR mature) AND NOT (gene OR brain OR cell) Results = 142 Second round results = 16	404	235	87	45	37
Regional spawning variation (Appendix 6)	3.5	TS = (Dicentrarchus OR labrax) AND TS = (spawn* OR "spawn* tim*" OR phenology OR reproduct* OR fecund*) AND TS= ("regional varia*" OR "seasonal varia*" OR distribut* OR spatial* OR mov* OR migrat*) Results = 178 Second round results = 14	TITLE-ABS-KEY (dicentrarchus OR labrax) AND ALL (spawn* OR "spawn* tim*" OR phenology OR reproduct* OR fecund*) AND ALL ("regional varia*" OR "seasonal varia*" OR distribut* OR spatial* OR mov* OR migrat*) AND NOT (gene OR brain) AND NOT TITLE-ABS-KEY (aquacult*) Results = 242 Second round results = 6	440	280	42	102	16

Topic	Report section(s)	WoS search string and initial article hit number (n)	Scopus search string and initial article hit number (n)	Total article hits	Excluded - title	Excluded - duplicate	Excluded - abstract	Retained articles
Essential habitat and use (Appendix 7)	3.8	TS = (Dicentrarchus OR labrax) AND TS = (nursery OR winter* OR habitat* OR "habitat* use" OR spawning*) NOT TS = (brain OR gene OR cell) Results = 569 Second round results = 41	TITLE-ABS-KEY (dicentrarchus OR labrax) AND ALL (nursery OR winter* OR habitat* OR "habitat* use" OR spawning*) AND NOT (gene OR brain OR cell) Results = 495 Second round results = 44	1149	696	270	126	57
Ecological interactions (Appendix 8)	3.9	TS = (Dicentrarchus OR labrax) AND TS = (biotic OR "bio* resistance" OR communit* OR "native comm*" OR "prey availability" OR "niche overlap*" OR "divergent niche*" OR resource* OR "resource* availability" OR niche* OR foodweb* OR "food web*" OR "food-web*") NOT TS = (cell OR brain OR gen) NOT TS = (aquacult*) Results = 234 Second round results = 34	TITLE-ABS-KEY (dicentrarchus OR labrax) AND ALL (biotic OR "bio* resistance" OR communit* OR "native comm*" OR "prey availability" OR "niche overlap*" OR "divergent niche*" OR resource* OR "resource* availability" OR niche* OR foodweb* OR "food web*" OR "food-web*") AND NOT ALL (gene OR brain OR cell) AND NOT ALL (aquacult*) Results = 148 Second round results = 27	443	207	91	113	32
Year class strength (Appendix 9)	3.3	TS = (Dicentrarchus OR labrax) AND TS = (recruitment* OR year class strengths* cohort strength*) NOT AB = (aquacult*) NOT AB = (aquacultur*) Results = 102 Second round results = 7	TITLE-ABS-KEY (dicentrarchus OR labrax) AND ALL (recruitment* OR "year class strengths*" OR "cohort strength*") AND NOT ABS (aquacultur*) Results = 214 Second round results = 7	330	184	78	41	27

Topic	Report section(s)	WoS search string and initial article hit number (n)	Scopus search string and initial article hit number (n)	Total article hits	Excluded - title	Excluded - duplicate	Excluded - abstract	Retained articles
Climate change (Appendix 10)	3.10	TS = (dicentrarchus OR labrax) AND TS = (climat* OR "climate change" OR "temperature increas*" OR "environment* condition*" OR warm* OR flow* OR precip*) AND TS = (distribut* OR spatial* OR mov* OR migrat*) NOT AB = (aquacult*) Results = 112 Second round results = 22	TITLE-ABS-KEY (dicentrarchus OR labrax) AND ALL (climat* OR "climate change" OR "temperature increas*" OR "environment* condition*" OR warm* OR flow* OR precip*) AND ALL (distribut* OR spatial* OR mov* OR migrat*) AND NOT TITLE-ABS-KEY (aquacult*) Results = 382 Second round results = 15	531	362	62	75	32

3. REVIEW OF BASS BIOLOGY AND ECOLOGY

3.1 Introduction

Bass is a distinctive fish with silver flanks, prominent spines on the dorsal (8 to 10) and anal (3) fins, a mouth that is moderately protrusible, and a moderately pointed head with the pre-operculum having a row of forward pointing denticles on the lower edge (Figure 3.1).

Figure 3.1. Bass captured from the tidal River Stour, Dorset (© J.R. Britton).

Bass has a wide distribution, ranging from northwest Africa to southern Scandinavia, with populations also present in the Mediterranean and Black Seas (Pawson and Pickett, 1996). While the species is distributed around the UK, summer populations in inshore areas tend to be most abundant on southern coasts, where they are exploited by both inshore commercial fishers and recreational anglers (Stamp *et al.,* 2021). The species has a relatively complex lifecycle, with spawning generally in offshore areas in spring, followed by a pelagic larval phase and then settlement in nursery habitats in inshore areas (especially estuarine habitats), where development from juvenile to adult fish can take several years (Sections 3.2 to 3.5). The fish then recruit to the mature stock where, whilst their spawning migrations can comprise long distances, they can also exhibit some fidelity to summer feeding grounds that often overlap with former nursery habitats (Sections 3.5 to 3.9). Recruitment success is driven primarily by environmental factors, especially temperature, with the relationship between Spawning Stock Biomass (SSB) and recruitment being relatively weak (Sections 3.3 and 4.3).

Whilst the management of bass fisheries involves stock units (Section 4.1), the movements and genetics of populations in the Atlantic area suggest some mixing and a lack of population structure across this part of their range (but with some structuring between Atlantic and Mediterranean stocks) (Section 3.6). This mixing and structuring, thus, has implications for bass management (Sections 4 and 5). With climate change altering sea temperatures and, potentially, the frequency of storm events and wave heights, there are implications for bass recruitment processes, distribution and the behaviour of bass fishers (Section 3.10).

Bass stocks form important inshore fisheries, especially for vessels < 10 m, where a seasonal fishery exploited using hook and line, and nets, exploits fish that attract a relatively high price compared with other demersal fishes (Section 4.7). However, in the context of demersal fish landings and values in the UK generally, bass are of relatively low importance (Section 4.7).

Bass stocks provide important recreational fisheries, where socio-economic values can be high (Section 4.6). Given the declines in both bass SSB and recruitment (Sections 4.1 and 4.3), it is important to understand how stock assessment processes operate, including how fishing opportunities are then allocated (Sections 4.3 to 4.5). In these stock assessment processes, ICES currently recognise four bass stock units for the Atlantic:

- 'Northern', comprising fish in the central and southern North Sea, Irish Sea, English Channel, Bristol Channel and Celtic Sea covering ICES divisions 4.b-c, 7.a and 7.d-h.
- 'Biscay', comprising of fish in the northern and central Bay of Biscay covering ICES divisions 8.a-b).
- 'West of Scotland and Ireland' covering ICES divisions 6.a, 7.b, 7.j.
- 'Atlantic Iberian' coverng ICES divisions 8.c and 9.a.

However, stock assessments are only completed for Northern and Biscay stocks (Section 4.1). As this report is concerned with evidence in support of developing the UK FMP, the emphasis is on the Northern stock. Thus, whenever the Northern bass stock is referred to in subsequent text, it refers to bass in ICES divisions 4.b-c, 7.a and 7.d-h (Section 4.1).

3.2 Life history traits

3.2.1 Life cycle

A diagrammatic overview of the bass life cycle is provided in Figure 3.2. The bass cycle involves an initial pelagic larval phase that follows adult spawning on grounds that are generally offshore and where the timing of spawning is influenced by latitude. Earlier spawning is apparent in more southerly latitudes (e.g. from January) at water temperatures of 13°C (Geffroy *et al.,* 2023), but with spawning as late as May and June in the Northern stocks, occurring within a temperature range of 8.5 – 11°C (Pawson *et al.,* 1987; Thompson and Harrop, 1987; Pawson and Pickett, 1996).

Spawning involves the broadcast spawning of planktonic eggs, with emergence at six to nine days and yolk sac absorption within 9 – 25 days (Pawson and Pickett, 1996). The pelagic larval stage lasts around 50 days (but can be up to 100 days), with these larvae drifting into coastal areas (Pickett and Pawson, 1994).

Post-larval bass then settle into nursery habitats (usually estuaries, but also coastal lagoons and shallow bays) where, in northern areas of their range, this occurs from May but can be as late as August (Pawson *et al.,* 1987; Kelley, 1988a; Pawson *et al.,* 2007a). As the fish develop into juveniles, they maintain residency in – or at least some dependency on – specific nursery areas for their initial years of life (e.g. two to four years) (Pawson *et al.,* 2007a,b).

Following maturity, individuals often maintain some fidelity to their summer feeding areas (e.g. use of areas in and around former nursery areas), but with migrations to offshore spawning grounds in winter.

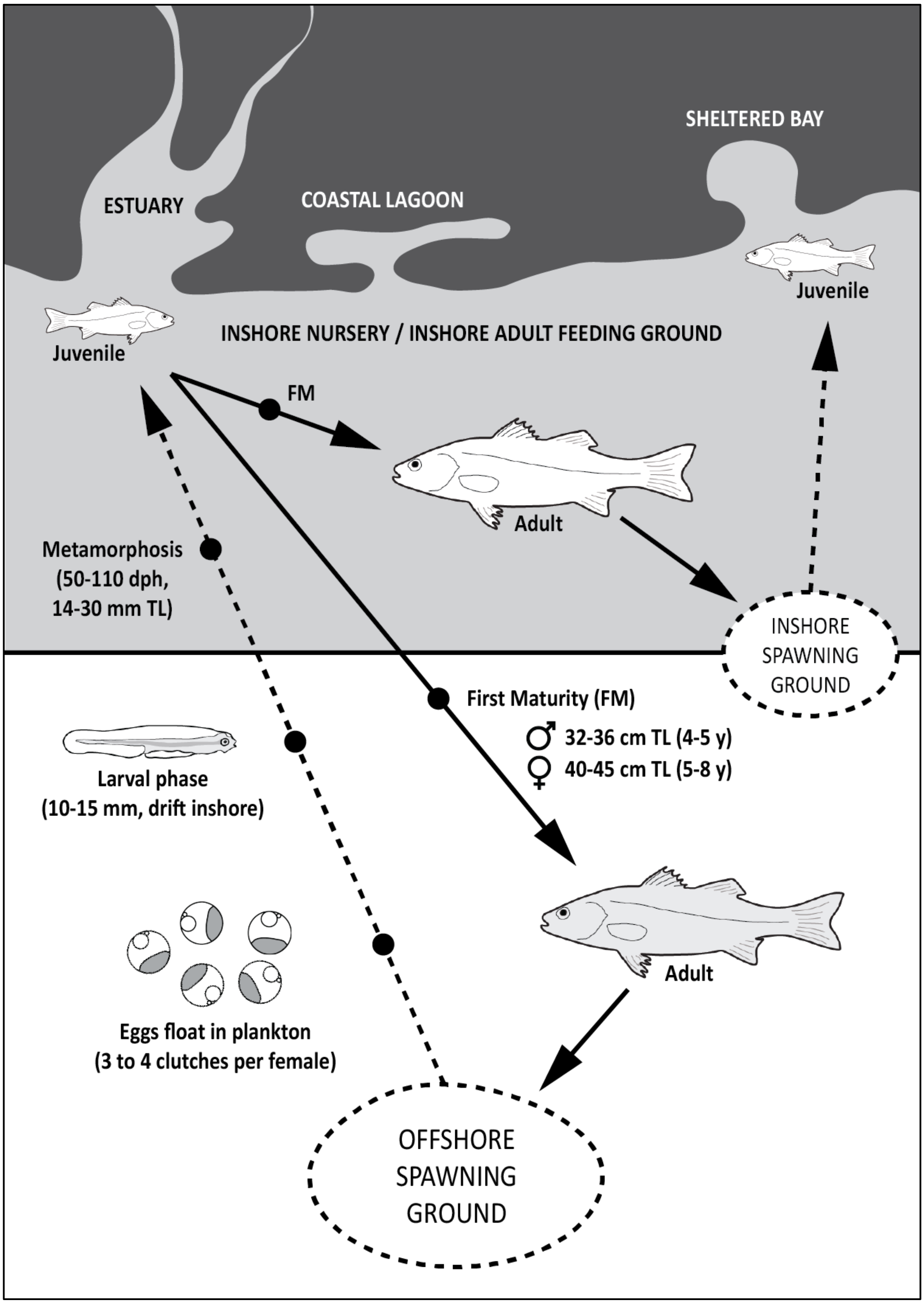


Figure 3.2. Overview of the bass life cycle, where the approximate ages relate to fish in the Atlantic range (dph = days post hatch; TL = total length; FM = first maturity).

3.2.2 Life span and growth rates

In general, bass is a long-lived and slow growing species, especially in the northern areas of their range, where individuals can live for up to 30 years (Pawson and Pickett, 1996). Growth in the initial years of life is relatively fast, with length increments at age reducing as sexual maturity is reached (at age four to six years old). There is a general trade-off between maximum length and annual growth rate, where fish with higher growth rates have lower maximum theoretical lengths, including in waters around Britain, but where growth rates can be substantially faster in more southern waters (Figure 3.3). Females tend to be faster growing than males, with some marked differences in lengths-at-age from around age four years old in the Wadden Sea (Netherlands) (Cardoso *et al*. 2015).

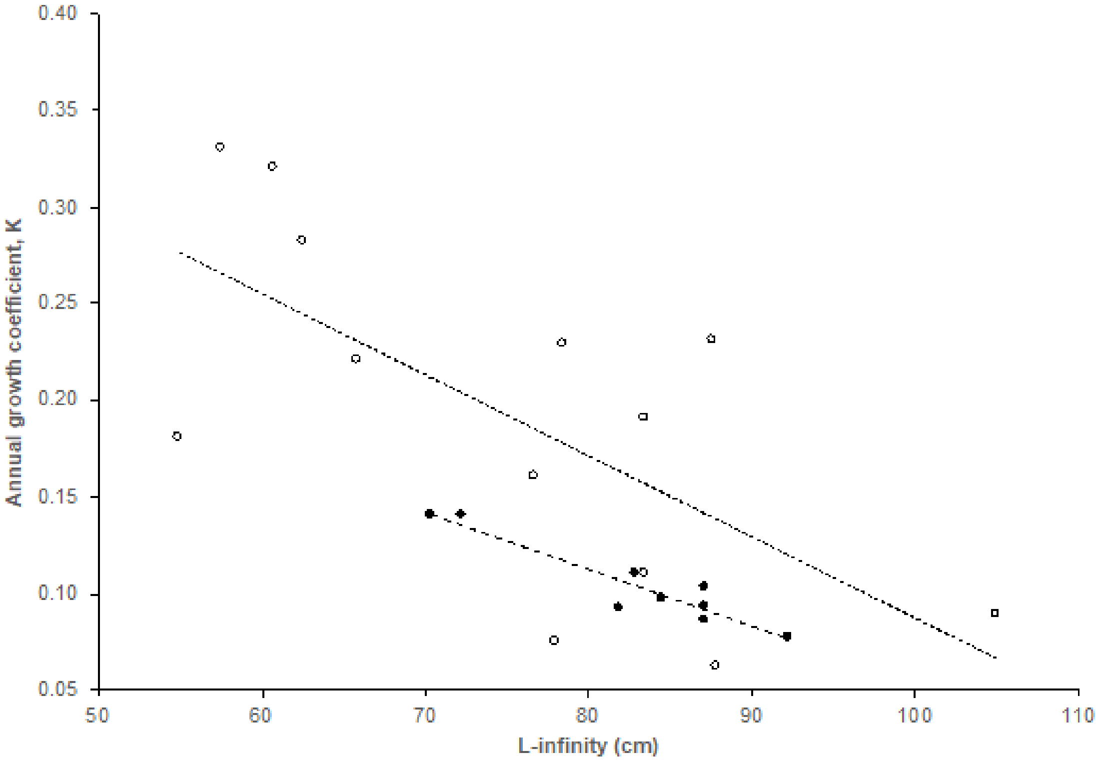


Figure 3.3. Relationship of the von Bertalanffy growth model parameters K (annual growth coefficient) versus L-infinity (maximum theoretical length), where filled circles are data for fish in the Northern stock (Celtic Sea through to the Southern North Sea), clear circles are for data from southerly populations (Portugal and Mediterranean), long dashed line is the significant relationship between the parameters for the Northern stock (R^2 = 0.89, F1,7 = 54.43, P < 0.01) and short dashed line is the significant relationship for the parameters for the southern populations (R^2 = 0.46, F1,1 = 9.51, P = 0.01) (Ahmed, 2011; Campillo, 1992; Cardoso *et al.,* 1992; Frose, 2022; Hichem Kara, 1999; Holden and Williams, 1974; ICES, 2016; Kara and Chaoui, 1998; Pauly, 1978; Wassef and El Emary, 1989).

In fitting growth curves from length data, ICES (2022a,b) suggested a maximum size in all areas of 84.5 cm, an annual growth coefficient (K) of 0.10 and an annual natural mortality rate (i.e. not including fishing mortality) of 0.24. Data from scale aging of over 6,000 bass captured mainly around the British coast between 1947 and 1986 revealed the fastest growth rates were on the south-east coast and slowest on the west, with year-classes of exceptional abundance tending to comprise slower growing fish versus average year classes, and warmer summers also resulting in faster growth (Kelley *et al.,* 1988). Annulus formation and the growth season of these juvenile bass was from early May and for adults from mid-July, and concluded for both in October (Kelley *et al.,* 1988).

In the Northern bass stock, studies on the lengths and growth rates of 0-group bass suggest a strong association with water temperatures in estuarine environments, with faster growth and larger realised lengths in warmer temperatures (Claridge and Potter, 1983). Indeed, there is a significant relationship between length at the end of the first growth season and latitude, with a pattern of larger lengths at lower latitudes (Figure 3.4). Temperature also influenced the condition and biochemical indicators in juvenile bass in a Portuguese estuary (Duarte *et al.,* 2018) and although warmer temperatures can favour growth, at constant food rations body condition indices can reduce in northern bass at 18 ^{o}C (Russell *et al.,* 1996).

A range of environmental factors other than temperature also influence 0-group bass growth rate, including prey availability, depth, salinity, river run-off and wind speed (Martinho *et al.,* 2009; Cardoso *et al.,* 2015; Bento *et al.,* 2016). 0-group body lengths are important as they affect critical swimming speeds, with faster swimming speeds associated with increased body length and time since hatching, and where at lengths > 15 mm, their swimming ability is sufficient to influence dispersal outcomes (Leis *et al.,* 2012). In autumn, the condition (as somatic and liver condition) and RNA:DNA ratios (a short-term measure of fish condition, higher ratios indicate higher condition) of bass in French marshes are relatively high, but then decline due to declining food intake and slowing metabolism until January, with these condition metrics then improving from February onwards as temperatures increase and the fish become acclimated to the colder conditions (Mustafa *et al.,* 1991).

As bass grow, there is a concomitant temporal shift in the relationship between their individual growth rates and mitochondrial metabolic traits, suggesting that the mitochondrial metabolic traits of individuals shift over time as their growth rates change (Quemeneur *et al.,* 2022). As post-larval bass enter estuarine nurseries, they are potentially going to be exposed to conditions of hypoxia at a sensitive life-stage, with a controlled experiment suggesting larvae in moderately hypoxic conditions respond by reducing energetically costly processes and regulating their mitochondria functions so they can respond to the energetically demanding conditions (Vanderplanke *et al.,* 2015).

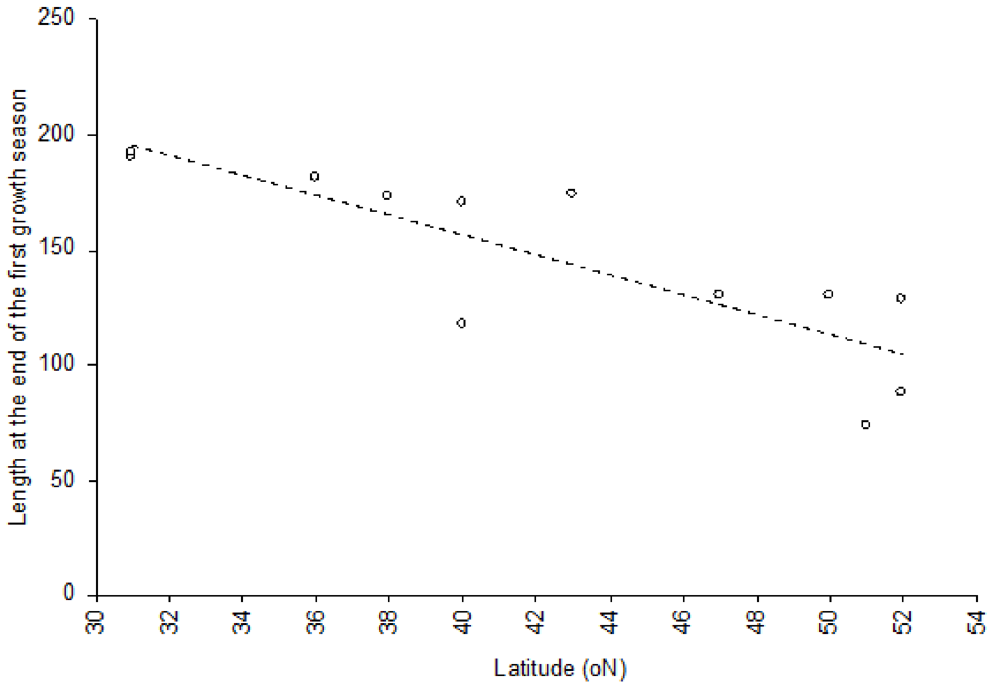


Figure 3.4. Significant relationship between 0-group length of bass at the end of their first growth season versus latitude (as oN) (R^2 = 0.71, F1,10 = 23.88, P < 0.01) (Arias, 1980; Barnabé, 1973; Cabral and Costa, 2001; Cardoso *et al.,* 2015; Claridge and Potter, 1983; Desaunay *et al.,* 1981; Gravier, 1961; Gordo, 1989; Hartley, 1940; Kennedy and Fitzmaurice, 1972; Martinho *et al.,* 2009; Wassef and El Emary, 1989).

3.2.3 Reproductive traits

Bass are a gonochoric species (e.g. sex is genetically determined and does not change throughout life). Spawning involves an annual cycle, with post-spawned fish then recovering from reproduction before starting to develop for spawning the following year (Figure 3.2). Bass are fractional broadcast spawners, spawning three to four times in quick succession, and where spawning involves the release of eggs and sperm into the water column (Mayer *et al.,* 1990).

In general, 50 % of females are mature at 41 cm (age three to six years, depending on location/growth conditions in early life) and males at 35 cm (age four to seven years) (Pawson and Pickett, 1996; Armstrong and Walmsley, 2012). In the English Channel and North Sea, all bass < 32 cm have immature gonads, low proportions of fish of 32 to 42 cm have ripe or spent gonads, but with most fish > 42 cm having ripe or spent gonads (Pawson *et al.,* 1987; Pickett and Pawson, 1994). In Ireland, females matured at minimum fork lengths 35.5 cm and males 31.5 cm (Kennedy and Fitzmaurice, 1972). Winter water temperatures can affect maturity, where temperatures < 9 °C delay maturity and retard ovarian development (Pawson *et al.,* 2000). In warmer Mediterranean waters, maturation is relatively early compared with bass in northern areas, with males maturing at two and females maturing at three years old (Kara, 1997). This spatial difference in age at maturity was inferred by Dambrine *et al.* (2020) as meaning that the older age at maturity in northern areas was at least partially environmentally driven, rather than being biological.

Sex ratios are generally biased towards females, although bass in similar inshore habitats can be dominated by either males or females (Diaz *et al.,* 2011). In captive conditions, higher temperatures produce more males than females (and the converse at cooler temperatures) (Koumoundouros *et al.,* 2002). Along the Portuguese coast, increasing temperatures along a decreasing latitudinal gradient was consistent with this pattern of sex ratios (Vinagre *et al.,* 2009). In Mediterranean bass, experiments that manipulated rearing temperatures revealed that higher temperatures resulted in more males, especially if these temperatures occurred in the larval stage, but with no temperature treatment producing fish of a single sex, indicating that sex differentiation has an underlying genetic basis (Mylonas *et al.,* 2005). While length at age data of male versus female bass suggests that Sexual Size Dimorphism (SSD) is apparent in the Northern range from around age 4 years, this SSD has also been detected experimentally in early life growth, where females have been suggested as growing faster than males by 83 days post hatching, which is before gonadal sex differentiation has started and perhaps even before sex has been determined, leading to a hypothesis of early growth being a cause rather than a consequence of SSD (Faggion *et al.,* 2021).

Due to their broadcast reproductive behaviours, fecundity of bass is generally high, with females producing up to 2 million pelagic eggs in total and > 500 eggs per gram of body weight across a single spawning season (Table 3.1; Mayer *et al.,* 1990). Bass shows group-synchronous oocyte development, with at least two egg batches (clutches) able to be distinguished. As a fractional spawner, discrete clutches are spawned in relatively quick succession, where successive clutches contain fewer eggs (Mayer *et al.,* 1990). The fecundity estimates of Mayer *et al.,* (1990) are reproduced in Table 3.1.

Table 3.1. Absolute and relative fecundity of 16 bass captured from Plymouth and Gower, UK (from Mayer *et al.,* 1990).

Location	Date	Age (years)	Weight (g)	Absolute fecundity	Relative fecundity (eggs g^{-1})
Plymouth	29/01/1984	17	3800	2043126	538
	29/01/1984	15	2650	1390023	525
	29/01/1984	11	2350	949094	404
	29/01/1984	8	2000	971933	486
	29/01/1984	9	2000	734121	367
	29/01/1984	9	1400	621799	444
Gower	28/04/1985	10	2250	1049027	466
	28/04/1985	9	1241	552512	445
	03/05/1985	8	1000	412789	413
	04/04/1986	9	1200	449434	375
	25/04/1986	10	1225	559513	457
	25/04/1986	9	1175	457567	389
	25/04/1986	9	1065	290390	273
	25/04/1986	9	1060	360014	340
	03/05/1986	10	1390	612153	440
	03/05/1986	10	1320	585000	443

The ratio between gonad weight and body weight of fish is described by the Gonado-Somatic Index (GSI) and, thus, provides information on approximate spawning times, where relatively high GSI coincides with the period immediately pre-spawning and when it falls to relatively low levels, indicates a post-spawned fish. GSI of bass sampled between January and August around the British coast revealed peak GSI in April (highest values at 23 %), and lowest from June (e.g. 0.5 %), with reduced GSI from April to May in the Bristol Channel and higher GSI in the North Sea than in the Bristol Channel in May (Figure 3.5; Bradley *et al.,* 2022).

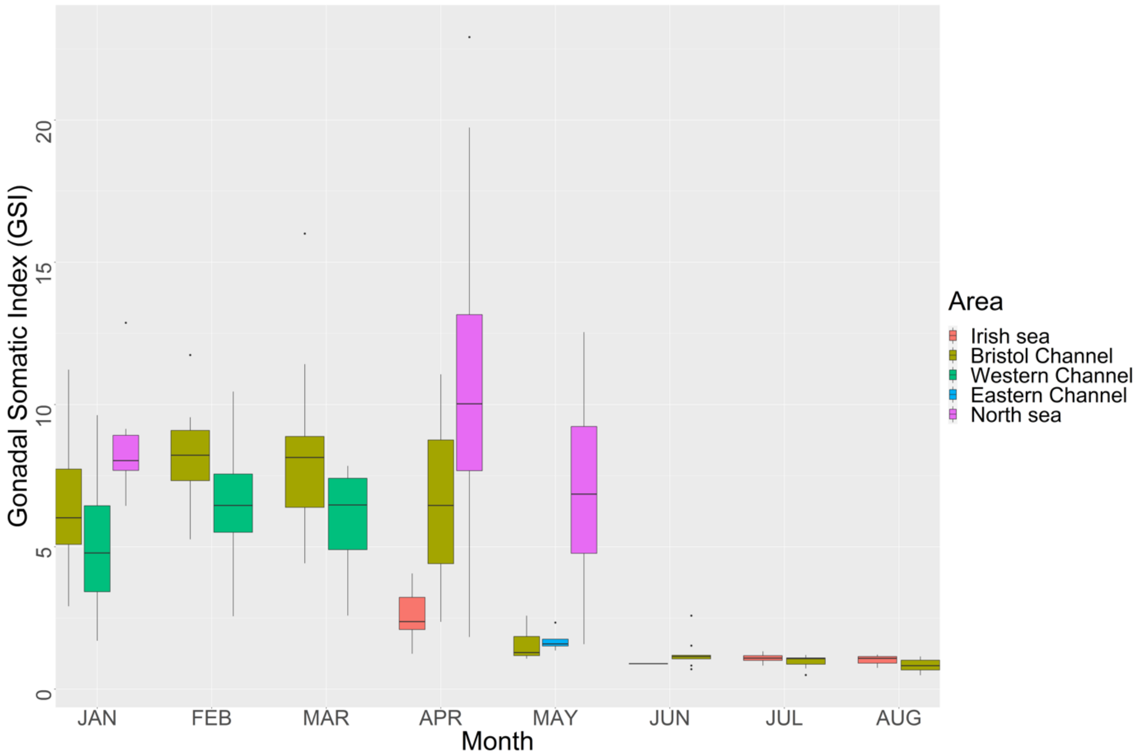


Figure 3.5. Gonado-Somatic Index (GSI) by month and location of female bass (n = 224) (from Bradley *et al.,* 2022).

3.3 Recruitment and early life history

3.3.1 Overview

Understanding the recruitment process is important in the context of its relationship on future spawning stock abundance, with a general understanding that the number of individuals that recruit into the mature stock determines the abundance of spawning stock (Kell *et al.,* 2016).

The relationship between stock size and recruitment (the Stock-Recruitment Relationship; SRR) is recognised as important for predicting future recruitment success, with SRRs used as the basis of many fishery management measures, including fisheries reference points, the effectiveness of harvest controls and predicting future fluctuations in stock size (Subbey *et al.,* 2014; see Section 4). Nevertheless, with SRRs rarely incorporating environmental drivers that influence inter-annual variability in 0-group survival then these relationships can be noisy, with no clear patterns apparent (Hilborn and Walters, 1992). Indeed, SRRs of bass have largely suggested that recruitment success is independent of stock size (Pawson, 2007a), with ICES (2022b) describing the stock: recruitment relationship as Type 5, where stocks show no evidence of impaired recruitment or with no clear relation between stock (S) and recruitment (R) (i.e., no S-R signal). Accordingly, understanding the factors influencing year class strength is fundamental for understanding why bass spawning stock size appears to be a relatively poor predictor of subsequent recruitment success.

Variability in the inter-annual recruitment of bass is also reflected in other temperate marine fishes, where a range of density independent factors (acting mainly, but not only, during the pelagic larval phase) and density-dependent factors (that act mainly on nursery grounds) influence recruitment success (Le Pape *et al.,* 2003; Cabral *et al.,* 2007; Le Pape and Bonhommeau, 2015; van der Veer *et al.,* 2015).

Estimated recruitment from stock assessment models (see Section 4.3) in the Northern bass stock is characterised by a relatively small number of very strong year classes since the mid-1980s (e.g. 1989, 1995, 1997), interspersed by year classes which are relatively weak - but with exceptionally poor recruitment in 1986, 1990, 1996 and 2010 (Figure 3.6; ICES, 2022b). In the Southern stock (Northern and Central Bay of Biscay), recruitment is also temporally variable, but with the more extreme patterns of weak and strong year class strength being less apparent. Spatial variation in recruitment is also apparent, with annual recruitment success in the Biscay stock less annually variable than in the Northern stock ICES, 2022b), perhaps due to the temperature conditions in Biscay stocks being generally more conducive for recruitment.

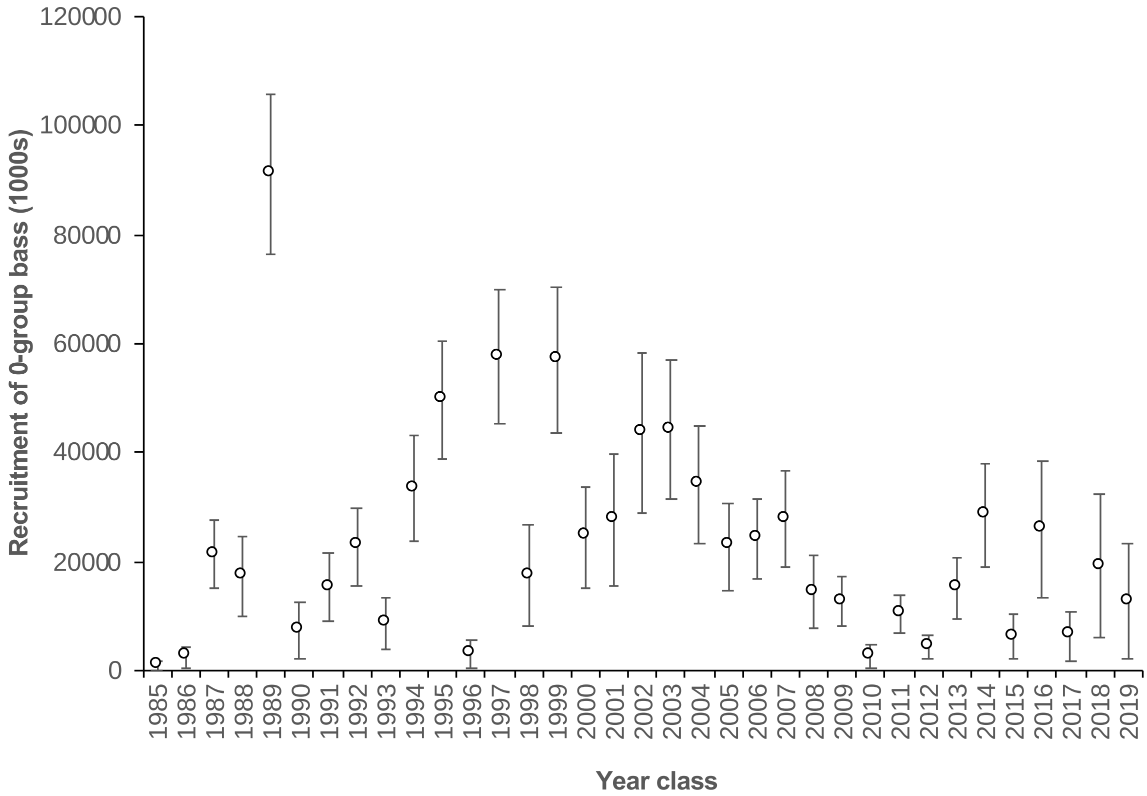


Figure 3.6. Estimated recruitment (as 0-group fish) of bass in the central and southern North Sea, Irish Sea, English Channel, Bristol Channel and Celtic Sea (ICES, 2022b).

3.3.2 Factors affecting bass recruitment success

A positive relationship between sea summer temperature and recruitment strength has been noted in a number of older studies (e.g. Kennedy and Fitzmaurice, 1972; Holden and Williams, 1974; Kelley, 1979), with increased summer growth of 0-group bass enhancing overwintering survival (Pickett and Pawson 1994). The 1989 strong year class had the highest 0-group abundance in the River Severn estuary for a 10-year period due to the warm summer and spring and, although the following two summers were similarly warm, 0-group bass abundance was much lower, suggesting alternative factors to temperature can also act on 0-group abundances (Holmes and Henderson, 1990).

Wind speed and direction during the spawning season have both been posited as important alternative factors through their facilitation of drift and dispersal (Holden and Williams, 1974; Kelley, 1979; Vinagre *et al.,* 2009). Juvenile abundance in nursery grounds have also been tested against river flows, sea surface temperature, the North Atlantic Oscillation (NAO) and chlorophyll *a* level, but with results having some context dependency between different nursery areas, suggesting that different factors are important at a local level (Martinho *et al.,* 2009; Vinagre *et al.,* 2009; Bento *et al.,* 2016).

In considering bass recruitment, it is important to consider the relevant life-stages and processes. In summary, spawning occurs offshore in salinities exceeding 30ppt and generally between February and June, with individuals potentially spawning between two and four batches of eggs (Section 3.2), later batches containing fewer oocytes than initial batches (Prat *et al.,* 1990). Spawning in more northern waters mainly occurs in March and April (but can occur much later too), but occurs earlier in more southerly latitudes (Kennedy and Fitzmaurice, 1972; Thompson and Harrop, 1987; see Section 3.2). Post-larval bass are first encountered in estuarine nursery areas in Britain from mid-May, although it can be as late as August (Dando and Demir, 1985; Aprahamian and Dickson Barr, 1985; Kelley, 1986). These juvenile bass are then often encountered initially in the upper estuary at salinities that are below 1ppt (Dando and Demir, 1985; Henderson and Corps, 1997), but with ontogenetic development, these 0-group fish are increasingly encountered at salinities of two to 14ppt; their peak abundances in upper estuaries occur in early autumn (Claridge and Potter, 1983; Aprahamian and Dickson Barr, 1985).

With the onset of autumn and winter, 0-group bass tend to disperse further downstream and into inshore areas for their first winter (Henderson and Corps, 1997). However, simulations of overwinter survival of 0-group cohorts in the northern range (e.g. East coast of England) suggest that periods of extreme cold (at least relative to more southern areas of the range of the species) result in complete mortality in estuarine habitats, so to survive they must move into deeper habitats (Freeman, 2022). Then, at ages between one and three years, the surviving juvenile fish remain in and around their nursery areas, even in winter (although movements to deeper water nearby is likely at those times) (Pawson *et al.,* 1987). As individuals approach maturity – and thus recruit into the spawning stock – they generally disperse from their nursery areas, increasing their time spent in inshore waters in summer and, as adults, undertake spawning migrations to much greater distances (e.g. 500 km; Pawson *et al.,* 1987; see Section 3.4).

Correspondingly, the following processes are considered here in more detail in relation to their contribution to the recruitment success of bass: (i) adult spawning and larval transport to nursery areas, (ii) settlement into nursery areas, (iii) autecology in the first year of life, and (iv) post 0-group survival and dispersal.

(i) Adult spawning and larval transport to nursery areas, including pelagic mixing

Pre-spawning migrations of bass to spawning areas is outlined in Section 3.4, where some fish undertake migrations of up to 500 km, with offshore areas considered as essential spawning areas (Dambrine *et al.,* 2021). There is a general latitudinal gradient in the timing of the onset of bass spawning, where there is an earlier onset in more southerly areas (Vinagre *et al.,* 2009). While temperature is a driver of spawning timing in more northerly areas, this is not considered the case in southerly areas where photoperiod is considered as having a more important role (Vinagre *et al.,* 2009).

In the Bristol Channel and eastern Celtic Sea, ichthyoplankton surveys in 1989 and 1990 indicated bass spawned mainly offshore during March and April, with larvae first encountered in these offshore areas from April (Jennings and Pawson, 1992). Conversely, back-calculated spawning dates of 0-group bass from otolith microstructure data (daily ages) in estuaries in south Wales suggested protracted spawning periods in 1988 and 1989, where spawning began in late February and continued to early June (1988) and early July (1989) (Jennings *et al.,* 1991). For 0-group bass on the Atlantic Iberian coast, daily ages from otolith microstructure showed that, in most years between 2011 and 2017, hatching occurred from February to April, corroborating the earlier spawning times of bass in more southerly latitudes, with earlier hatching detected in 2012 (early January) (Pinto *et al.,* 2021).

During the spawning period, females release ripe ova in batches (usually two to three batches) over a period of two to three weeks, with ova being pelagic and fertilised in open water (Mayer *et al.,* 1990; see Section 3.2). Interannual variability in hatching times are associated with differences in sea surface temperature, the position of the North Atlantic Oscillation (NAO) and chlorophyll a concentration (Pinto *et al.,* 2021). Larval emergence generally occurs between four and eight days post-spawning, with larvae being pelagic (Henderson and Corps, 1997). These larvae then begin a pelagic phase for between 40 and 100 days (Jennings *et al.,* 1991; Pinto *et al.,* 2021).

An Individual Based Model (IBM) that simulated the settlement of 0-group bass on nursery grounds predicted that larval dispersal from spawning areas to nurseries was driven mainly by the influence of wind on residual currents and sea temperature, where stronger currents increased larval drift distances and higher temperatures reduced the length of the pelagic phase (Beraud *et al.,* 2018). An IBM that was coupled with a particle tracking model predicted that spawning areas in the western Channel and Celtic Sea can supply larvae widely, so providing connectivity across the Channel and Celtic Sea, and into the Irish Sea, but where nurseries in some regions dependent on more local spawning, such as the Solent estuary, southern England, which was predicted as being dependent on Channel sources only (Graham et al., 2023)

The population genetic structure of bass (Section 3.6) could be influenced by this pelagic stage, where there is potential for mixing of larvae spawned in different areas that would dilute any structuring that would otherwise be imposed by spatially discrete spawning areas. Information on the influence of this mixing, and indeed whether this mixing occurs, is largely limited to information from simulations. For example, the average per-generation dispersal distance of larvae within the bass Mediterranean lineage was predicted as less than 50 km (Duranton *et al.,* 2018). The IBM of Beraud *et al.* (2018) predicted that eggs spawned in the central western English Channel would produce larvae that settle in nursery areas in both England and France, but with movement from the central to eastern English Channel only occurring in warmer years. The IBM also predicted that larval duration would increase from southwest to northeast areas of the northern stock, being driven by temperature, although this would not have implications for mixing (Beraud *et al.,* 2018). There, thus, remains considerable uncertainty in the role of larval mixing in determining bass population structure (see Section 3.2).

(ii) Settlement into nursery areas

After their pelagic phase, bass larvae reach coastal waters where they then metamorphose into juveniles and actively settle in nurseries, such as saltmarshes and estuaries (Jennings and Pawson, 1992). In Britain, it is considered that all non-polluted estuaries from the Ribble Estuary in the northwest to the Blackwater in the southeast are likely to provide bass nursery habitats (Kelley, 1986, 1988), with 37 estuaries and coastal areas designated as Bass Nursery Areas (BNAs) in England and Wales since the 1990s (Cefas, 2018).

Similarly, bass nurseries in France have been characterised as different types of sheltered shallow habitats, including habitats that are both natural (e.g. coastal lagoons) and artificial (e.g. marinas) (Dufour *et al.,* 2009). Bass nurseries have been described as non-synchronous, semi-isolated locations of varying environmental conditions (and hence why there can be context-dependency in the factors affecting 0-group abundance in these locations (Pawson *et al.,* 2007a)), but that all have the potential to contribute to recruitment (Pickett *et al.,* 2004).

Settlement in the northern stock is highly correlated with temperature, with poor settlement in cooler years (ICES, 2012a,b). Settlement timing is closely associated with spawning and hatching times, being earlier in more southerly areas; for example, occurring between April and June in the north-west Mediterranean, but not starting until at least late-June in the Bristol Channel where, again, temperature was an important determinant of settlement timing (Reynolds *et al.,* 2003).

Sampling of 0-group bass in nurseries suggests that several pulses of fish arrive into these areas, where the fish have a strong orientation capacity but limited swimming ability (Dufour *et al.,* 2009). Arrivals into nursery areas can vary in body length and although bass larvae of between five and 11 mm can be captured close to estuarine nursery areas, they do not tend to enter nursery areas until they are post-larvae of 15 to 20 mm (Jennings *et al.,* 1991). However, some studies have reported bass in estuaries as small as 10 mm (Dando and Demir, 1985; Aprahamian and Dickson Barr, 1985; Kelley, 1986).

The IBM of Beraud *et al.,* (2018) predicted that highest settlement success was associated with tidal migration in the final larval stage, with Alp and Le Pichon (2021) suggesting that tidal colonisation processes across tidal cycles can disrupt habitat availability and connectivity and, thus, create temporary bottlenecks for movements into these habitats. However, empirical evidence of bass using tidal stream migration was minimal in an estuary in Eastern England, where reliance on passive tidal forcing was considered more likely (Freeman, 2022).

Following their arrival into estuarine nurseries, these bass are often transported by the tide to low salinity areas in the upper estuary (Dando and Demir, 1985; Henderson and Corps, 1997). As the 0-group bass develop in their nursery areas, they move into areas of salinities of two to 14 ppt, with their peak abundances in larger upper estuaries occurring in early autumn (Claridge and Potter, 1983; Aprahamian and Dickson Barr, 1985). With the onset of autumn and winter, 0-group bass tend to disperse further downstream and into inshore areas for their first winter, resulting in few 0-group bass in the upper estuary (Henderson and Corps, 1997).

(iii) First year of life

A major factor that influences the survival of individual 0-group bass and, correspondingly, the strength of their year class, is growth rate in their first summer of life. The reason why growth rate is important to consider is that a body length (Total Length, TL) of 60 mm has been suggested as representing the critical length for survival through the first winter of life in the Northern stock, as fish below this length store relatively little lipid (Lancaster *et al.,* 1998). Thus, nursery areas in which 0-group bass rarely reach lengths above 60 mm might be unlikely to contribute strongly to population recruitment.

There are some spatial differences in growth rates between estuaries with, for example, sites on the south Wales coast to the west of Swansea Bay less likely to attain 60 mm by the end of their first growth year than at sites to the east (Lancaster *et al.,* 1998), and with 0-group bass in the Tamar estuary growing faster than those in the Camel estuary in southwest England (Kelley *et al.,* 2002). Indeed, length at age 1 has been suggested as being a strong predictor of year class strength, where larger fish result in stronger recruitment success (Kelley, 1998), although this is only likely to apply in more northern areas, given larger body sizes in more southerly areas (Section 3.2, Figure 3.4).

In estuaries in south Wales, growth rates were a function of the characteristics of their environments, rather than their hatching dates, with prey availability considered as a growth limiting factor (Jennings *et al.,* 1991). The diet of 0-group bass during this period tended to comprise mainly of crustacea, polychaeta and mollusca (Martinho *et al.,* 2008; see Section 3.9). However, differences in growth between sites in a given year were relatively small versus inter-annual differences that were temperature related (Jennings *et al.,* 1991).

Where warm-water effluents are discharged from power stations into estuaries, growth of 0-group bass can be enhanced, resulting in reduced over-winter mortality, although some fish might also be lost through entrainment on water intake screens (Pawson and Eaton, 1999).

The abundance and production of 0-group bass in nursery areas can, thus, be strongly climatically influenced, even in more southerly latitudes, where the effect of the changes in the NAO can be measured; although, more local factors such as salinity and chlorophyll a can also be important (Martinho *et al.,* 2009; Bento *et al.,* 2016). In addition, in periods where green macroalgae grows in profusion and results in 'green tides' (as seen in some beaches in northwest France, through the growth of *Ulva* spp.), 0-group bass can be adversely affected, exhibiting reduced growth when macroalgal densities are medium and a complete absence of bass at high macroalgal densities (Le Luherne *et al.,* 2017).

Deleterious impacts on 0-group bass abundance on year classes that would ordinarily be predicted as being highly abundant according to abiotic variables can also occur if the preceding year classes were strong, as the high numbers of age one and two bass in nursery areas can cannibalise the 0-group fish (Henderson and Corps, 1997).

Finally, it is not only the current environmental constraints that can influence growth rates of these fish, but also the carry-over effects of past events that influenced growth rates, such as post-settlement performance being influenced by their larval traits in combination with conditions experienced in nurseries (Teichert *et al.,* 2023). For example, analyses of otolith microstructure revealed fast growing larvae were characterised by a shorter pelagic larval duration, but larger size at recruitment - but with larval trait impacts on post-settlement traits being minor compared with the effect of conditions in the nursery environment (Teichert et al., 2023).

(iv) Post 0-group survival and dispersal from nursery habitat

Once the first year of life has been survived, multiple tagging and tracking studies have indicated a tendency for these individuals to remain relatively local to their nursery areas (e.g. Pawson *et al.,* 1987; Doyle *et al.,* 2017; Stamp *et al.,* 2021; see Section 3.4). This was explored further by Pickett *et al.* (2004), who tagged and released 6,435 bass of < 36 cm in 11 nursery areas around England and Wales from 1988 to 1994. While reported recaptures were low (235 fish), 66 % were over the minimum landing size at that time (36 cm) and, crucially, 65 % of all tagged fish were recaptured in fisheries local to the tagging sites. However, 22 % of recaptures were in fisheries outside their home regions, suggesting some regional mixing (Pickett *et al.,* 2004). This mixing was uneven, with the southeast fishery having few incoming fish, but the northwest receiving fish from nursery areas in all other regions. Also of importance was that only four of 235 recaptured bass were from non-UK fisheries, emphasising that measures to protect bass nursery areas in England and Wales should accrue benefits within the inshore fisheries of those countries.

3.3.3 Summary

Considerations on the recruitment success of bass need to account for all early life stages, from the timing and location of spawning through to dispersal from nursery grounds as adolescent and/or mature fish (although some of these will return in subsequent summers to feed).

The weak relationship between stock size and recruitment already suggests that other factors play an important role in determining recruitment success, with the insights into the early life stages of bass in this section emphasising the role of environmental conditions, especially – but not exclusively – temperature. The role of biological factors, such as density dependence and predation pressure, appear secondary.

Indeed, rather than being able to develop general rules on the conditions required for high 0-group survival and subsequent strong recruitment, the environmental drivers of survival in nurseries are varied, with the potential for context-dependency across different estuarine nurseries. Years of warm spring and summer temperatures, with favourable winds in the pelagic and larval stages, tides that enable larvae to access estuarine nurseries at critical times, and high primary and secondary production in those nurseries, will all favour the production of a strong year class, especially if the recent year classes have been weak. However, sufficient uncertainty means that even spawning years where a strong year class is predicted, might not manifest in reality.

3.4 Bass movements and associated behaviours

3.4.1 Overview of bass tagging methods

A range of tagging methods have been employed to track the movements of bass. Older studies focused on primarily using external tags that enabled individual identification of fish but did not allow active tracking, only the location of their release site and subsequent recapture (e.g. floy tags) (e.g. Pawson *et al.,* 1987). The advantage of these tags, however, is that they enabled the inexpensive tagging of large numbers of fish across a wide spatial area.

More recently, a range of new tag technologies have been used, most notably archival tags that enable data on the movements of the tagged fish to be reconstructed once the tag has been retrieved. These are typically Data Storage Tags (DSTs) that are implanted into the fish and are recovered either when the fish are captured by fishers or when the fish has died, the tag has been released from the body and washed ashore and found by a member of the public who has subsequently returned it to the address on the tag (e.g. Quayle *et al.,* 2009). Data retrieved from DSTs tend to include temperature and depth, allowing movements to be reconstructed using spatial modelling methods (e.g. Thygesen *et al.,* 2009). Thus, even where relatively large numbers of fish are implanted with DSTs, only a relatively small proportion might ever be recovered. Pop-off satellite tags (PSAT) are externally attached to fish and programmed to be released from fish when data recordings suggest a dead or dying fish. Once detached, data are transmitted from the tag via a specific satellite network, although if the PSAT is physically recovered then more accurate tracking data can be constructed as the raw data are in higher resolution (Doyle *et al*., 2018).

Acoustic telemetry has been used in more recent years, where an acoustic transmitter is implanted into the body cavity of the fish. An acoustic pulse is emitted by the transmitter at a programmed interval (e.g. 90 s), which is then detected on an acoustic receiver deployed within a receiver network (e.g. Doyle *et al.,* 2017). Thus, the efficacy of acoustic telemetry is heavily dependent on the spatial extent of the deployed network of receivers; fish moving outside of the range of the network are unable to be detected. In addition, the relatively high expense of acoustic transmitters also limits the numbers of fish that are tagged. The following sub-sections outline the main results of studies using these different methods.

3.4.2 Mark-recapture studies

In Ireland, 895 bass were tagged between 1967 and 1970, with 25 tagged individuals recaptured by October 1971; these fish were captured up to 68 km from their original location, but with distance travelled not proportionate to the time between tagging and recapture (Kennedy and Fitzmaurice 1972).

There were then 5,959 bass tagged externally between 1970 and 1984 in locations around the English coast that were used to infer seasonal distribution patterns and movements of bass populations in the southern North Sea, the central English Channel and the south-west and west coasts (Pawson *et al.,* 1987). Juvenile fish generally remained within 80 km of their release area, but with a small proportion of tagged juveniles on the west coast (< 3 %) being recaptured further north in the summer and further south in the winter. Adolescent bass tended to show dispersal patterns similar to juveniles, but with higher proportions recaptured at relatively large distances from their release site and with some moving into areas where neither juvenile nor adult fish from the original tagged area were recovered (Pawson *et al.,* 1987). Adult movements tended to occur in autumn, with movements from summer feeding areas to winter pre-spawning areas, and their return in spring, with distances moved generally up to 100 km for adults from southwest England, but 400 to 500 km for fish from Anglesey (moving to Cornish waters) and the Thames Estuary (moving to the western English Channel). Some adults moved into the Bay of Biscay in winter, moving distances > 800 km from their summer release area (Pawson *et al.,* 1987).

A further tagging study of 4,959 bass between 2000 and 2005 largely supported the results of Pawson *et al.* (1987), as recaptured fish revealed adult migration patterns were largely unchanged in bass that spent summer along the coasts of the English Channel, and west and northwest England and Wales (Pawson *et al.,* 2007a, 2008). However, there was a marked reduction in the number of adult North

Sea bass captured offshore in the western Channel during spawning periods, suggesting a loss of this migratory route, although some anecdotal evidence suggested that it had remained (Pawson *et al.,* 2007a). Overall, these additional tagged fish strongly affirmed the findings that, while bass do not necessarily move far in summer (e.g. 55 % of all recaptured fish across both datasets being captured within 16 km of their release location; Pawson *et al.,* 2008), adults can move considerable distances to offshore winter spawning areas (Pawson *et al.,* 1987).

3.4.3 Data Storage Tag studies

An early study based using DSTs tagged 89 bass in the North Sea and English Channel, but with only 11 recaptured (Quayle *et al.,* 2009). Of these recaptures, five evidenced some migrations of over 100 km, while the others were recaptured relatively quickly and close to their release site. The most common behaviour detected was bass maintaining position in mid-water and making frequent ascents and descents of two to 10 m; although, some diving behaviours were also detected when individuals would descend to over 120 m, with the latter primarily involving those fish that had migrated long distances (Quayle *et al.,* 2009).

The use of inshore and estuarine summer feeding areas detected in mark-recapture studies (Pawson *et al.,* 1987, 2007) has also been observed in DST data, where in 21 recovered DSTs of 246 deployed tags off the west Brittany coast, fish that were at liberty for extended periods would return to similar inshore areas following their spawning (de Pontual *et al.,* 2013). However, differences in the movements made by individual bass were apparent in their spawning migrations; most fish moved to the Bay of Biscay to spawn, but some moved into the Celtic Sea and English Channel.

The recovered number of DSTs reported in de Pontual *et al.* (2013) then increased to 36, with the extended dataset indicating that the maximum experienced depth by bass was over 225 m, with individuals exposed to a temperature range of 6.8 to 21.9 °C (de Pontual *et al.,* 2019). As with the initial data, some fidelity to summer feedings areas and winter spawning areas was demonstrated, with long distance migrations again being either towards the Celtic Sea or Bay of Biscay, but with some residency behaviour in the tagging area in some individuals. It was, thus, suggested that there was some spatial structuring in the bass population, where the tagging area (west coast of Brittany) represented a mixing zone for different stocks (or sub-populations), including a sub-population of fish that are primarily resident in this area (de Pontual *et al.,* 2019).

A more recent study incorporated DST data with otolith microchemistry, where 1,220 bass were tagged between 2014 and 2016 (Le Luherne *et al.,* 2022). Of 470 tags that were recovered, 42 had been at liberty for at least two winters, with their otoliths removed on recapture. Coupling of the two methods involved reconstructing spawning movements from DST data to assign either the English Channel or Bay of Biscay as the spawning location, with otolith microchemistry then supporting this through identifying spawning areas from larval and adult chemical tracers (Le Luherne *et al.,*. 2022). Spawning site fidelity was evident, but only in 64 % of the fish, with a geographical gradient of site fidelity apparent, being highest at the northern and southern limits of the study region. The otolith microchemistry data indicated patterns of difference in zinc, barium and strontium were similar between larval and adult stages of individuals, suggesting a homing behaviour, although further insights from the otolith data were not possible (Le Luherne *et al.,* 2022). The application of otolith geochemical tags to 385 bass in Irish estuaries revealed high discrimination of 0-group bass between estuaries, with results then indicating that 91 % (age 1) and 95 % (age 2) bass remained close to their original settlement site; where migration between estuaries was suggested, it was only to those that were adjacent (distance < 50 km) (Ryan et al. 2022). Thus, these juvenile bass were showing strong fidelity to their settlement areas, with otolith geochemistry providing potential for identifying the role of different estuaries to overall recruitment success.

3.4.4 Pop-up Satellite Archival Tags

The application of Pop-up Satellite Archival Tags (PSATs) to relatively small fish (such as bass) is constrained by these tags being relatively large size, with their external attachment potentially raising ethical and welfare concerns. Nevertheless, 12 adult bass were successfully tagged with (PSATs) in Irish coastal waters between 2015 and 2016, with archived data retrieved for five fish (O'Neill *et al.,* 2018). Three of these fish had been into inshore waters, with these fish moving offshore during their general spawning season before returning back to their approximate locations of origin. During their apparent spawning movement, they shared similar space to the offshore fish in the spawning period. Given that commercial exploitation is not permitted for bass in Irish waters, then the application of PSATs provided information on spawning movements and aggregations that could not be provided by the application of DSTs (O'Neill *et al.,* 2018).

3.4.5 Acoustic telemetry

More recent work has focused on the application of acoustic telemetry to track the movements of bass over time and space, with studies completed in Ireland (Doyle *et al.,* 2017) and southwest England (Stamp *et al.,* 2021), and with preliminary work in southeast England demonstrating minimal effects of tag attachment on bass survival and behaviour (Moore *et al.,* 1994).

In Ireland, 30 bass (40.5 – 78.0 cm; mean ± SD: 54.5 ± 9.5 cm) were implanted with a 9 mm diameter transmitter, with 90 % of the fish still being detected in the receiver network after 315 days (Doyle *et al.,* 2017). Most of the tagged bass remained resident to specific areas (93 % return rate), some home ranges being less than 3 km, with all fish having clearly defined core resident areas. Large-scale movements outside of these areas were unable to be tracked due to no receivers being present in those areas.

The southwest England study implanted acoustic transmitters into 146 bass of 25 to 60 cm, with up to 76 % of fish remaining within 20 km of their capture site (Stamp *et al.,* 2021). As with other studies, some individuals remained resident throughout summer, but with some remaining in winter also - including fish of lengths that indicated sexual maturity. Given the spawning areas of bass are primarily offshore (e.g. Pawson *et al.,* 1987), these overwintering fish potentially skipped a spawning migration (Stamp *et al.,* 2021). Some fish were also tracked moving up to 317 km from their capture site, being detected on receivers in other coastal areas (including off the Welsh coast), although 81 % of these returned to their original capture site (Stamp *et al.,* 2021).

3.4.6 Non-tagging approaches to track movements

The relatively limited movements of bass that are made in summer revealed by all of the tagging methods has also been supported by stable isotope-based studies (based on $\delta^{13}C$ and $\delta^{15}N$), where fish from Welsh waters were correctly classified to their collection region on approximately 75 % of occasions (Cambié *et al.,* 2016). The results also suggested there were two sub-populations across the data that were using discrete spawning grounds (in south and mid/north Wales).

3.4.7 Summary of bass movement data collected by multiple tagging methods

Inferences derived from these different tracking approaches demonstrate some congruence in their insights into bass movements in summer, winter and during spawning periods. All of the tagging methods have indicated that bass are a relatively mobile species that shows specific seasonal movements involving both inshore and offshore habitats, with some fidelity to inshore feeding areas and winter spawning areas (i.e. some philopatry).

One of the main values of DSTs is their revelation that bass use deeper, offshore waters that could be indicative of spawning areas and aggregations. Across studies, there is a suggestion that there is some connectivity and mixing of bass in the English Channel and North Sea, including migrants to the Bay of Biscay (primarily fish from the western English Channel), but with this mixing less apparent in the Irish Sea. Thus, these tagging studies suggest there is some mixing across sub-populations that could suggest a lack of genetic structuring across their range (Section 3.6).

3.5 Regional variation in spawning times

Spatial differences in the spawning periods of bass are apparent across their range (Barnabé, 1980; Vinagre *et al*., 2009). Spawning activities in more southerly latitudes commences as early as October and concludes in the following January (Arias, 1980; Figure 3.7). In Portugal, there is a clear latitudinal gradient in the commencement of spawning, where spawning in areas around the Mira Estuary (37.5 °N) commences in mid-December but does not commence until mid-February in the following year in the Ria de Avero (40.5 °N) (Vinagre *et al.,* 2009).

Populations at more northerly latitudes have been reported as commencing spawning as early as February, with peak spawning in April in the English Channel and eastern Celtic Sea (Pawson and Pickett, 1996) (note that current management regulations only close the fishery in February and March; Section 4.1). However, spawning is considered to occur later in the North Sea, where bass eggs have been sampled from the water column in May (van Damme *et al.,* 2011a, b). The timing when spawning activities are concluded has been difficult to decipher but is considered to be May at the earliest in the North Sea, where DST data suggest movements into shallow waters in June; although, spawning in Ireland has been detected into mid-June (Kennedy and Fitzmaurice, 1968).

Spawning timings are important, as they determine the timing of the pelagic period and settlement of 0-group fish, as well as the length of their first growth season (and so the maximum lengths they can realistically attain; Section 3.2.2, Figure 3.4). Studies on captive bass indicate that photoperiod is important in determining spawning time, with advances/delays in spawning able to be induced by constant long/short days (e.g. Devauchelle and Coves, 1988). Thus, it is likely that bass will spawn at times determined by photoperiod, providing temperatures are appropriate.

In the case of Portuguese populations, these temperature conditions are considered to be favourable for most of the year, hence spawning being triggered primarily by photoperiod (Vinagre *et al.,* 2009). However, further north it is likely that temperature becomes more important as a spawning trigger, where photoperiod cues the pre-spawning movements and development of the fish but temperature determines the actual timing when spawning commences.

In the Northern bass stock, the spawning times presented in Figure 3.7, derived from tagging data, are also supported by survey data, where spawning times in the western English Channel are supported by ripe adult fish being captured by pelagic trawling in January to March and eggs subsequently being sampled in planktonic egg surveys (Thompson and Harrop, 1987; Jennings and Pawson, 1992). Data on the spatial and temporal patterns in bass feeding, condition, and gonad development from the coasts of England and Wales (Pawson and Pickett, 1996; Masski, 1998) also provide support for bass spawning offshore in the English Channel and eastern Celtic Sea between February and May (Pawson *et al.,* 1987).

Finally, recent data on the GSI of bass sampled in British waters suggest that, other than in the North Sea, there are few ripe females present in samples in May, and none in June, including fish captured from the Irish Sea (Figure 3.5; Bradley *et al.,* 2022).

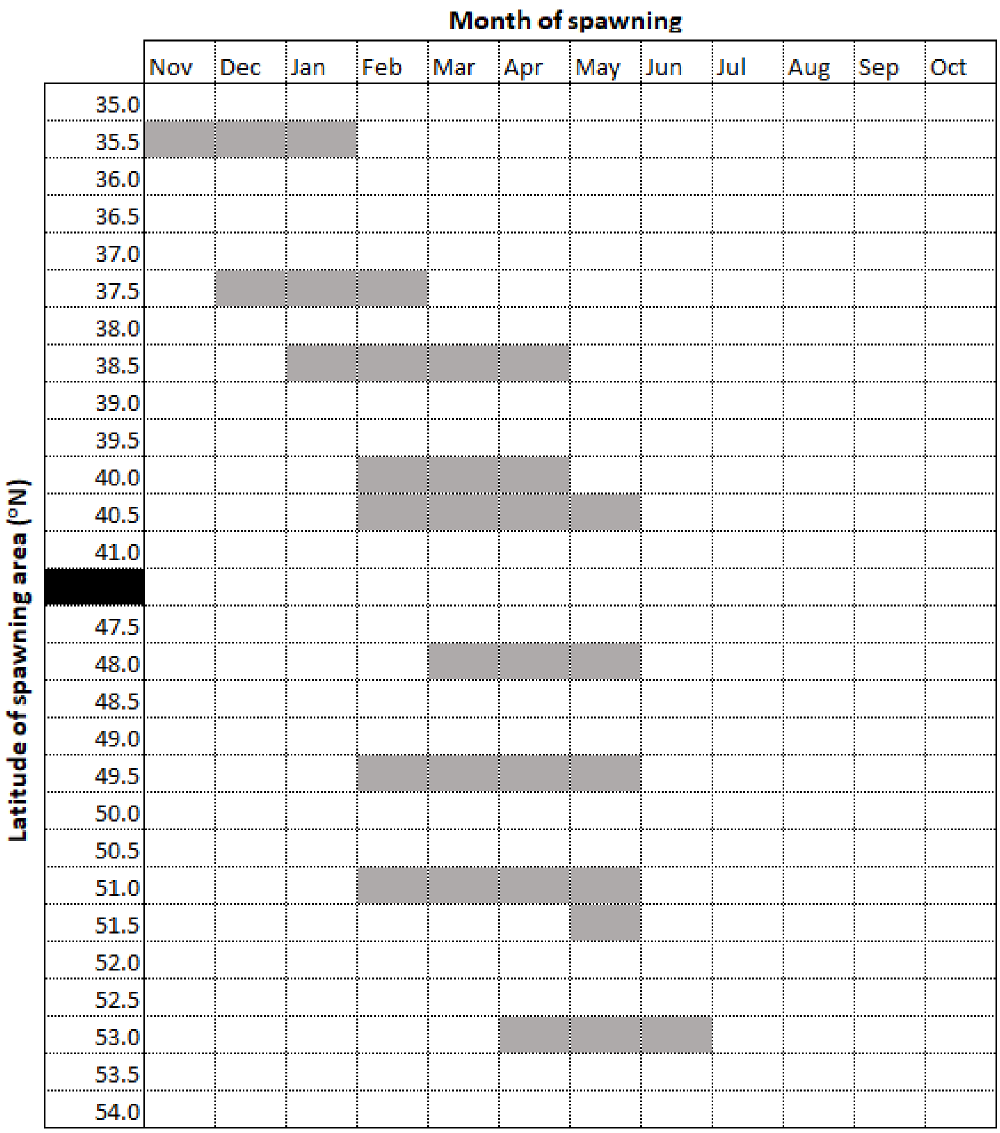


Figure 3.7. Months of bass spawning activity (grey shade) versus latitude, where the black cell represents a break in the latitude of completed studies (Kennedy and Fitzmaurice 1968; Chevalier 1980; Arias 1980; Pawson 2007).

3.6 Genetic stock structure

Studies on bass population genetics over the last 30 years have used a diverse range of genetic markers, with a spatial bias on studying structuring in Mediterranean populations, with work on-going to resolve genetic structuring across the Atlantic bass stocks as new analytical methods emerge and evolve. Early studies tended to focus on applying mitochondrial markers, such as the cytochrome c oxidase subunit 1 (COI) mitochondrial gene (Ali and Mamoon, 2019), Cytochrome *b* (Lemaire *et al.,* 2005), allozymes (Castilho and McAndrew, 1998; Erguden and Turan, 2005), and microsatellites (Bodur *et al.,* 2017; Fritsch *et al.,* 2007). The advance of next generation sequencing means that the bass molecular toolbox has expanded to include genome level studies. The economic importance of the Mediterranean aquaculture industry, coupled with a strong drive to genetically inform bass broodstock selection practices, means the species now has a complete genome, Quantitative Trait Loci (QTL) maps, and Single Nucleotide Polymorphism (SNP) maps (Sarropoulou and Fernandes, 2011; Louro *et al.,* 2014; Vandeputte *et al.,* 2019, Penaloza *et al.,* 2021).

The combination of marker-specific and genomic-level studies indicates three genetic bass metapopulations: Atlantic (AT), West Mediterranean (WM), and East Mediterranean (EM). The AT and Mediterranean (WM and EM) populations were extensively separated during the Pleistocene, followed by secondary contact of the allopatric AT and WM lineages during the last glacial maximum, which can be detected genetically (Quere *et al.,* 2012). Following this secondary contact, the main gene flow was of AT genotypes mixing and spreading along the WM populations (Duranton *et al.,* 2019, 2020), with evidence that the WM population resulted from a hybrid swarm between AT and EM populations (Quere *et al.,* 2012).

Genetic separation between the WM and EM populations has remained, although is being diluted by contemporary aquaculture practices through WM broodstock being used in cage aquaculture in the eastern Mediterranean (through escaped fish then introgressing with wild EM fish) (Bodur *et al.,* 2017). This aquaculture industry also initially introduced AT genotypes into the eastern Mediterranean (Bodur *et al.,* 2017, Youngston *et al.,* 2001). There has also been some geneflow – although at a lower level – of WM genotypes to AT, resulting in introgressed genes, with WM genes detected in bass samples as far north as the Irish sea (Robinet *et al.,* 2020). This is critical from a fisheries management perspective, as it can inform the stock units used by ICES in fisheries assessments (Section 4).

Mitochondrial markers have identified three main mitochondrial lineages within the Atlantic region:

- Atlantic 1 (Bay of Biscay and ancestral line to the Mediterranean lineage).
- Atlantic 2 (European coast).
- Atlantic 3 (British Isles and Norway) (Coscia and Marianni, 2011).

However, the presence of lineages has not subsequently been confirmed using neutral genetic markers (e.g. microsatellites, SNPs), with these suggesting only weak population genetic structuring between southern Atlantic populations (Faro and Morocco) and northern populations (Souche *et al.,* 2015). This weak genetic structuring forms the basis of the conservative stock management units in the Atlantic-Northern Atlantic population and Bay of Biscay (Section 4).

Despite the use of neutral genetic markers providing strong evidence of panmixia, there is some indication that the markers under selection (e.g., allozymes, Major Histocompatibility Complex [MHC] genes) do indicate some genetic structuring. For example, Castilho and McAndrew (1998) used six allozyme loci to reveal genetic structuring in bass along the Portuguese coast, where the most southerly and northerly populations were more genetically differentiated (i.e. isolation by distance). Differentiation between the Bay of Biscay and southern North Sea populations was suggested by analyses of the somatolactin gene (Quere *et al.,* 2010). More recently, there is evidence of private alleles and differentiation between the Celtic Shelf and Portuguese populations via analyses of MHC class I genes (Ratcliffe *et al.,* 2022), although this study was based on relatively small sample sizes (n = 62 across six populations) and used genomic DNA where there is a risk that some alleles are pseudogenes. However, recent unpublished recent work using neutral SNPs from samples across a wide range of Atlantic bass populations did not identify any genetic structuring, with analyses of outlier SNPs identifying three possible genetic clusters that were independent of geography (Hyder et al., 2022).

Non-genetic markers could also provide useful information of population structuring, with two sub-populations of bass in Welsh waters corresponding to two separate feeding grounds (south vs mid-north Wales) identified using carbon and nitrogen stable isotope ratios ($\delta^{13}C$ and $\delta^{15}N$ (Cambié *et al.,* 2016). The application of mercury stable isotopes in bass sampled from the North Sea, Seine Estuary, Portugal and the Mediterranean (Cransveld *et al.,* 2017) was able to distinguish between the Seine and Mediterranean populations, but not between the North Sea and Portuguese populations.

In summary, genetic studies on bass are biased by the influence of the aquaculture sector in the Mediterranean, but this has resulted in a diverse toolbox of genomic tools for application to population genetic studies, especially where loci under selection are targeted. Most studies suggest no genetic structuring across Atlantic bass populations, where the presence of genetic clusters was not spatially driven. By continuing to combine information on movements and mixing gained from tagging studies with genetic studies, there is potential for the extent of structuring (or otherwise) across the Atlantic range to be decoupled further

3.7 Abundance and coastal distribution

Estimates of bass population abundances in coastal areas (other than estimates of stock size biomass; see Sections 4.1 and 4.3) have tended to focus on 0-group and juvenile life-stages, where work across their range has had a strong focus on estuarine nursery areas. In these habitats, bass are frequently encountered in juvenile fish surveys, irrespective of sampling method, with the species usually present in relatively high abundance and/or as a dominant species by number in estuaries as far south as Portugal and as far north as the Severn and Thames estuaries in the UK (Table 3.2). Periods of peak bass abundance in these estuaries varies; however, peak abundance in the northern stock tends to be in early autumn (Claridge and Potter 1983; Aprahamian and Dickson Barr, 1985; Table 3.2).

In England and Wales, the coastal distribution of juvenile bass extends from the River Ribble Estuary in northwest England to at least the Blackwater estuary in the southeast, with all non-polluted estuaries considered as likely to have juvenile bass present (Kelley, 1986, 1988). There were 37 estuaries and coastal areas designated as Bass Nursery Areas (BNAs) in the 1990s (Cefas, 2018). Although distributed between northwest England and south round to northeast England, the only two BNAs north of 53.3 °N are both power stations (Heysham in the northwest and Blyth in the northeast.

Approximately half of BNAs are along the southern coast of England (Figure 3.8). Thus, while bass do have a relatively wide distribution around England and Wales, this appears to be biased towards more southerly areas. However, this spatial distribution might also be an artefact of a lack of sampling in many estuaries, especially in Northern England, and so bass summer distribution might be more extensive in northern Britain than currently realised.

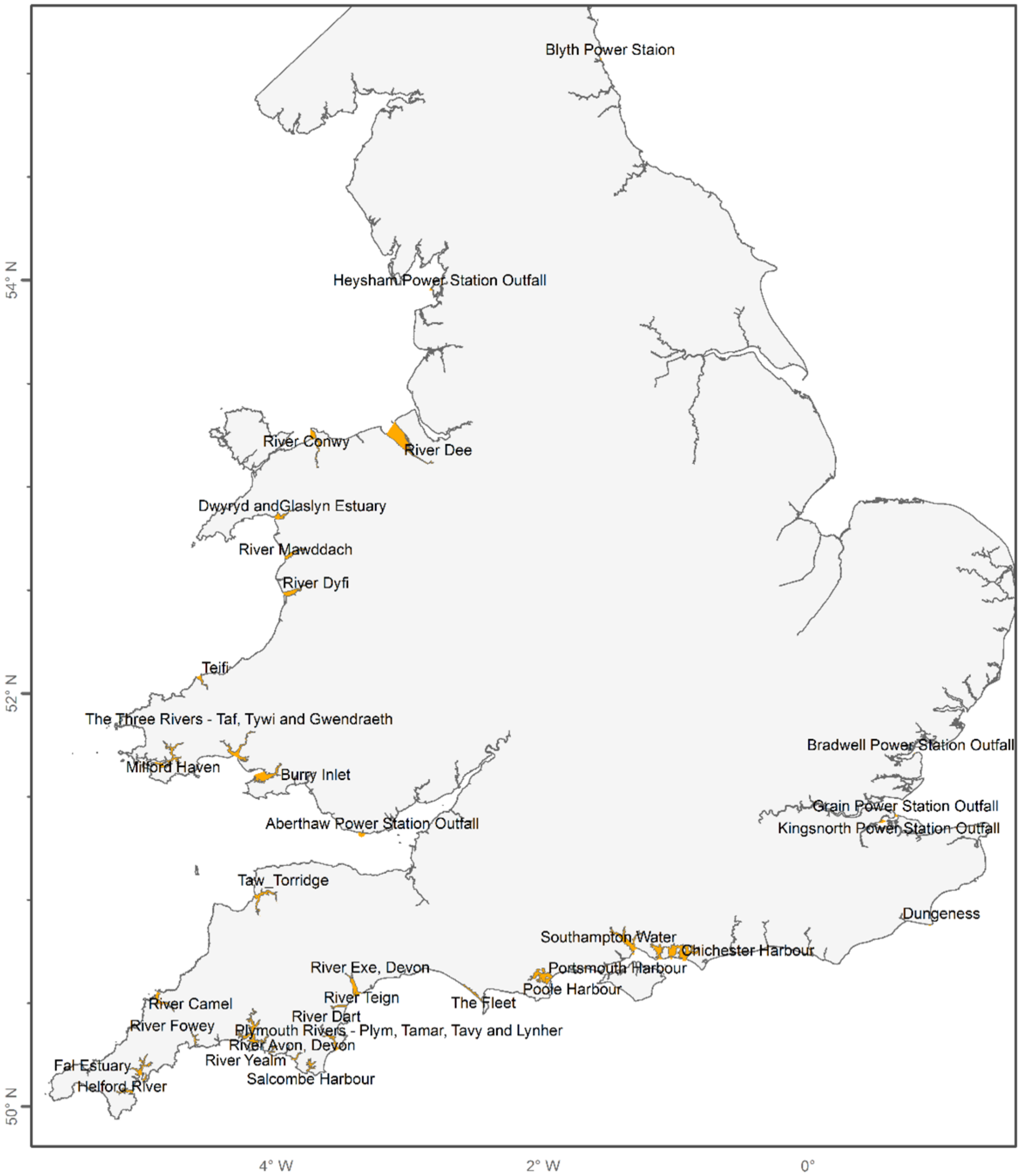


Figure 3.8. Bass Nursery Areas (BNAs) in England and Wales that were specified under Statutory Instrument 1999 No 75 The Bass (Specified Areas) (Prohibition of Fishing) (Variation) Order 1999 (Cefas, 2018).

This distribution bias is emphasised by the sampling of power station cooling screens located on river estuaries (Henderson, 2017). At Sizewell (Suffolk) and West Thurrock (Essex) power stations, bass were recorded at very high abundance, whereas at power stations at Hartlepool (County Durham) and Longannet (Fife), only one individual bass was recorded across all years (Henderson, 2017). In addition, bass relative abundance in samples collected from Sizewell increased from 0.3 % in 1976 to 37 % in 2011, with their rank order of abundance changing from 31st in 1982 to 2nd in 2010. The reason for this increased relative abundance was considered as multifactorial, including increased availability of nursery areas, habitat changes favouring their prey species, increased niche availability due to cod decline and/or a more favourable thermal regime (Henderson, 2017).

Temporal increases in bass abundance have also been seen in the Dutch Wadden Sea where, over 50 years, large fluctuations in bass abundance were apparent but with an underlying increasing trend from approximately 1990 to 2007, followed by declines thereafter to 2010 (Cardoso *et al.,* 2015). The increase to 2007 was attributed to environmental conditions (temperature, salinity) becoming optimal for juvenile growth from the mid-1980s; although, high prey abundance was considered important for maintaining bass abundance in spring and autumn (Cardoso *et al.,* 2015).

Within estuarine nurseries, bass distribution varies by development stage and size. As post-larval bass settle in estuaries, they often inhabit the upper area of the estuary where salinities are affected by river inflows (Dando and Demir, 1985; Henderson and Corps, 1997) (Figure 3.9). As the fish develop, their spatial distribution expands, with 0-group fish in autumn being encountered at much higher salinities than earlier in the summer. Thereafter, there is a shift in distribution, with deeper waters often sought, leaving many previously inhabited areas of estuaries having few over-wintering fish (Kelley, 1988a), with this consistent with the simulations of Freeman (2022) that predicted complete mortality of 0-group fish in estuaries in Eastern England due to them acting as a thermal trap due to their cold temperatures. At ages between one and three years, many of these juvenile fish will remain in and around their nursery areas, even in winter (although movements to deeper water nearby is likely) (Pawson *et al.,* 1987; Figure 3.9). As individuals approach maturity, and thus recruit to the spawning stock, they generally disperse from nursery areas, increasing time spent in inshore waters in summer and, as adults, undertake spawning migrations over much greater distances (Pawson *et al.,* 1987).

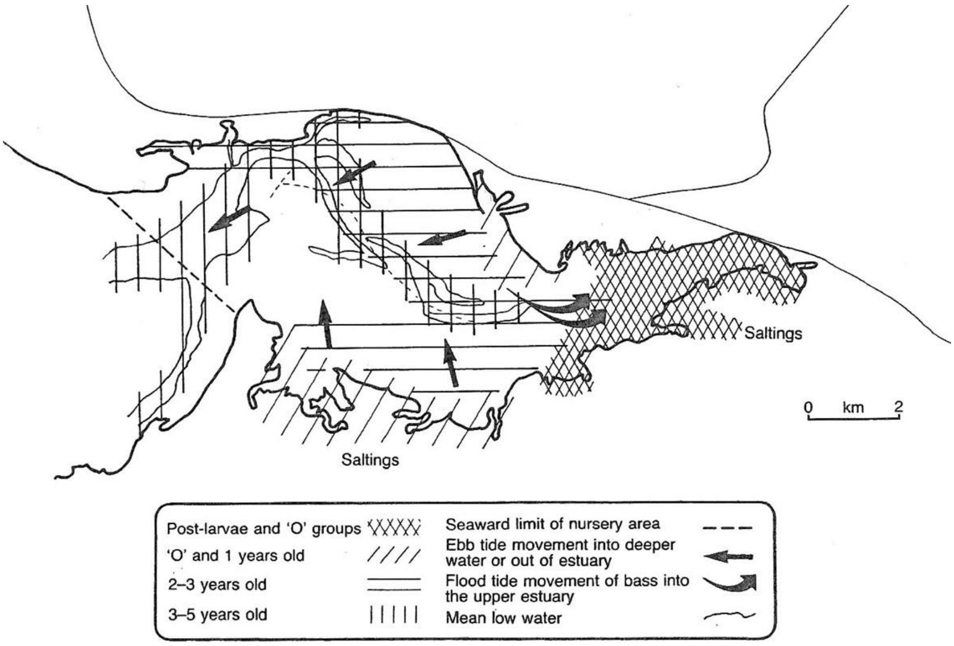


Figure 3.9. Distribution and behaviour of different bass life stages in a typical estuarine nursery, reproduced from Pickett and Pawson (1994).

For bass of approximate lengths 20 to 30 cm in the Loire estuary, France, data collected from demersal trawls were used to generate density distribution maps and revealed that these fish mainly use areas between the upper and lower estuary, where salinities were between 10 and 30ppt, with no density hotspots for these bass at salinities < 10ppt (Roy *et al.,* 2022).

Finally, marine reserves with no take zones can have marked and positive influences on bass abundances and sizes. Underwater visual censuses in shallow inshore waters in rocky shore areas in- and outside of a marine reserve area in the northwestern Mediterranean Sea revealed relative sea bass abundance was consistently higher within the reserve area, with larger individuals present. This was attributed to the prohibition of spear fishing within the reserve (Jouvenel and Pollard, 2001).

In the Medes Islands MPA/NTZ of the northwestern Mediterranean, the recovery of a bass population was detected across 19 years of visual census data where, by the end of the period, bass abundance was considered to be close to carrying capacity. This contrasted to peripheral areas open for fishing where much lower biomass was evident, suggesting limited spillover (Garcia-Rubies *et al.,* 2013).

Table 3.2. Summary of relative sea bass abundances and/or timing of presence and habitat associations from estuary and inshore areas across their Northern and Biscay ranges.

Location	Sampling method	Relative abundance / Timing of presence / Habitat association	Reference(s)
British North Sea coast	Sampling of power station cooling screens	Greatly increased in abundance in inshore areas since the 1970s; most abundant south of Spurn head;	Henderson, 2017
Severn Estuary, inner Bristol Channel	Sampling of power station cooling screens	Peak abundances of juvenile bass between September and early November.	Claridge and Potter, 1983
Severn Estuary, Western England	Micromesh seine net, power station cooling screens	Post-larval bass first recorded in late July with juveniles recorded until October.	Aprahamian and Dickson Barr, 1985
Poole Bay, Southern England	BRUV	Larger fish on natural versus artificial reefs	Hall *et al.,* 2021
Inshore waters off Plymouth	2m ring trawl	In late May 1970, 15 post-larval bass were sampled, having previously only being captured singly in previous surveys.	Russell, 1935; Russel and Demir, 1971
Medway Estuary	Trawls	Power stations on estuaries can have deleterious impacts on juvenile bass abundance through entrainment on screens, but can also increase growth rates and enhance overwinter survival through fish using warm-water effluents	Pawson and Eaton, 1999
Thames Estuary	Nets across screens at West Thurrock Power Station	Co-dominant species in samples taken September to November	Araujo *et al.,* 2000
Zeeschelde Estuary, Belgium	Fyke net	8th most numerically abundant species in samples	Briene *et al.,* 2011
Westerschelde Estuary, Netherlands	Stow net	Common species in nekton samples of late summer	Cattrijsse *et al.,* 1994
Surf zone, Belgian beaches	Beach seine	Bass used surf beaches as transient habitats between nursery areas	Beyst *et al.,* 2001
Canche Estuary, N France	Beam trawl and fyke nets	Peak abundance in November at 221 n 1000m^{-2}; lowest in July at 0.2 n 1000m^{-2}. Fourth most abundant species across all samples.	Selleslagh and Amara, 2008
Óbidos Lagoon, Portugal	Beach seine	One of seven dominant species	Serrano Gordo and Cabral, 2001
Prevost Lagoon, NW Mediterranean	Beach seine, cast net, dip net	Juvenile bass associated with habitats of warmer temperatures and higher macrophyte cover.	Lotti *et al.,* 2023
Mediterranean lagoons	Hydro-acoustics, local fishing methods	Most abundant fish species but not a strong indicator of habitat quality	Brehmer *et al.,* 2013
Tagus Estuary	Beam trawl	Highest bass densities in shallow areas, with increased abundance as temperature and salinity increased	Cabral and Costa, 2001
Mondego Estuary	Beam trawl	Important nursery area, highly abundant species by biomass; encountered in all sampled habitats; 0-group abundance affected by river run-off, precipitation and east-west winds.	Leitao *et al.,* 2007; Martinho *et al.,* 2007, 2009

Location	Sampling method	Relative abundance / Timing of presence / Habitat association	Reference(s)
NW Mediterranean coast	Underwater visual census	Density of fish varies according to extent of habitat modification; highest densities on coastal defence structures, lowest in harbours, but with some jetties having juvenile fish densities similar to natural sites	Mercader *et al.,* 2018
Tejo Estuary, Portugal	Fyke net	Bass were most abundant in samples taken in spring and summer.	Salgado *et al.,* 2004
Rivers Minho, Douro, Ria de Aveiro, Mondego, Tejo, Sado, Mira, Ria Formosa and Guadiana, Portugal.	Beam trawl	Bass one of five most abundant fishes in samples, present in well-defined sites in most of the estuaries; bass occurrences were largely explained by salinity, depth, percentage of mud in the sediment and macro-zoobenthos density (some differences between estuaries)	Vasconcelos *et al.,* 2010

3.8 Essential habitat and habitat use

3.8.1 Spawning habitats

Information on the spawning habitats of bass is relatively limited due to their open water spawning behaviours. While De Pontual *et al.,* (2019) suggested adults do show some fidelity behaviour to spawning areas, scientific surveys on bass spawning aggregations remain rare, especially in the North Atlantic stock, with few examples where adult or egg sampling has targeted spawning areas (but see Thompson and Harrop, 1987; Jennings and Pawson, 1992; van Damme *et al.,* 2011a, b for examples of where eggs have been sampled). While data on spawning areas can be derived from fisheries data, these data are often biased to issues including gear selectivity, target species (i.e. whether bass were target species or by-catch) and external conditions, including weather and prevailing management measures (Maunder *et al.,* 2006).

Recent application of data collected by a vessel monitoring system, however, has enabled application of nonlinear geostatistical approaches to detect spawning aggregations in the Northern bass stock in spawning areas along the French Atlantic coast and English Channel (Dambrine *et al.,* 2020). This approach was used to predict the recurring spawning areas of bass in these areas, with persistence of their distribution across months and years determined using Bayesian spatial-temporal analyses. It be noted, however, that these distributions are a function of fishing effort in that region and so does not provide direct evidence of bass spawning in these areas, given the data are based on catches of fish that were concentrated in those areas at times when spawning generally occurs. Nevertheless, the study predicted the presence of three key spawning areas:

- Rochebonne Plateau, Bay of Biscay, W°28, N 46°12: An essential spawning area during the entire spawning season, but where much of the rest of the Bay of Biscay was generally unfavourable for bass spawning.
- Western English Channel: A recurring spawning area, particularly in February, but with much of the northeastern part of the English Channel being unfavourable for reproduction.
- North of the Cotentin Peninsula in the eastern English Channel: (W 1°71, N 50°27): A stable spawning area throughout the spawning season, with one area southwest of Hampshire showing very high probability of spawner occupancy in March.

The results also indicated a shift northward during the spawning season, with a decreasing pattern in the Bay of Biscay between January and March, shifting eastward between January and April in the English Channel, peaking in February and March (Dambrine *et al.,* 2020; Table 3.3 and Table 3.4). There was also significant annual variability in the extent of the spawning areas in the Bay of Biscay and the English Channel (Table 3.3 and Table 3.4).

Table 3.3. Spawning area extent (km²) per month and year in the Bay of Biscay (reproduced from Dambrine *et al.,* 2020).

	2008	2009	2010	2011	2012	2013	Mean	SD
January	10248	7779	926	1173	2963	2160	4208	3872
February	5031	2438	2068	1728	1481	1605	2392	1339
March	3611	926	802	1389	1450	1697	1646	1020

Table 3.4. Spawning area extent (km²) per month and year in the English Channel-Celtic Sea (reproduced from Dambrine *et al.,* 2020).

	2008	2009	2010	2011	2012	2013	Mean	SD
January	12100	7130	7748	13,829	8828	5463	9183	3173
February	15619	18428	13613	6050	15125	5463	12383	5367
March	13952	19262	8519	14909	16360	10094	13849	3981
April	8519	10649	6575	5402	4043	11915	7851	3063

However, the approach used was insufficient to predict the spawning areas according to environmental variables, which it suggested that 'stock memory' (the learning of migration routes by virgin fish from experienced adults) and homing were processes that potentially influence the persistence of specific spawning areas, but with further work needed to test this (Dambrine *et al.,* 2020).

3.8.2 Nursery and feeding habitats

The use by 0-group and juvenile/adolescent bass of estuaries as nursery habitats has already been outlined at length in Section 3.3, where it has been argued that virtually all non-polluted estuaries in coastal waters around England and Wales could provide important habitats, with specific use of spatial areas within estuaries varying by developmental stage (Figure 3.9; Pickett and Pawson, 1994; Roy *et al.,* 2022). Indeed, inshore and estuarine habitats provide critical feeding and refuge habitats for juvenile bass across their range (e.g. Claridge *et al.,* 1986; Kelley, 1988a,b; Cattrijsse *et al.,* 1994; Beyst *et al.,* 1999; Bussotti and Guidetti, 2010; Guerreiro *et al.,* 2021). Post-larval stages tend to use upper reaches of estuaries of relatively low salinity, with larger 0-group fish then using areas of intermediate salinities, before fish of ≥ 1 year using a wider range of habitats across the estuary (Figure 3.9; Roy *et al.,* 2022).

Of high importance in the context of bass early life history and, thus, recruitment is that these juvenile life-stages have high fidelity to specific areas within estuaries. Indeed, significant differences in the stable isotopes of $\delta^{13}C$ and $\delta^{15}N$ between salt marshes across five river estuaries in southeast England demonstrated limited connectivity between saltmarshes within the same estuary that drove patterns of strong site fidelity in 0-group bass (and other fishes) (Green *et al.,* 2012). The acoustic tracking work completed by Doyle *et al.,* (2017) and Stamp *et al.,* (2021) on larger juvenile and sub-adult bass then suggested that aspects of this fidelity, at least at the level of nursery areas, is a strong feature in the life history of many individuals, especially in summer (Section 3.4). Indeed, stable isotope data from bass > 50 cm from Welsh waters generally had estuarine signatures (indicated by relatively low $\delta^{13}C$), emphasising that estuaries can remain important summer feeding habitats for adult bass (Cambié *et al.,* 2016).

Within bass nursery areas, intertidal saltmarsh comprises important feeding habitat. When saltmarshes are inundated by the flooding tide, juvenile bass enter these areas, with up to 38 % of fish have empty stomachs; on leaving up to two hours later (as the tide ebbs), up to 98 % of these fish now have full stomachs, with individuals having consumed prey mass of up to 8 % of their initial body mass (Laffaille *et al.,* 2001; Fonseca *et al.,* 2011). In estuaries where access to saltmarsh habitats is absent, 0-group bass diets can still comprise high proportions of mysids (e.g. *Neomysis integer*) whose energy sources include detritus derived from saltmarsh (Fockedey and Mees, 1999). In saltmarsh creeks in Belgium and the Netherlands, juvenile bass preyed upon a wide range of prey items that were present in excess volumes, with the creeks also providing good refuge from piscivores (Hampel *et al.,* 2005; Section 3.9). Indeed, the value of saltmarsh habitats as bass nurseries is such that they have been considered to contribute up to 18 % of the commercial landing values of the species in the UK (NB. based on expert judgment) (McCormick et al., 2021).

Notwithstanding the above, many saltmarsh fish communities are temporally variable across the year, such as in southeast England where communities are highly diverse in spring, dominated by bass and *Pomatoschistus microps* in summer, and then having low diversity in winter, with juvenile bass often at low very abundance (Green *et al.,* 2009). Juvenile bass in the inner Severn Estuary were present in samples in late summer and October, but then migrated seawards with the onset of winter (Aprahamian and Dickson Barr, 1985). In bass nurseries along the northwest Mediterranean Sea, the number of settling individuals varies between sites from very small numbers to several thousand, with intra-site differences also apparent between years (Dufour *et al.,* 2009).

The preference of juvenile bass to use vegetated versus unvegetated habitats in nurseries is equivocal, where their densities and biomass were greater in unvegetated habitats in a coastal lagoon in Portugal (Erzini *et al.,* 2022), but where preferences were shown for use of seagrass habitats elsewhere in Portugal and in the Adriatic (Vasconcelos *et al.,* 2010; Bussotti and Guidetti, 2011). In saltmarshes in France, juvenile bass do not forage exclusively on vegetated tidal flats, with feeding across a range of habitats, including tidal creeks (Laffaille *et al.,* 2001).

Given the extent of saltmarsh loss in recent decades (10 hectares are lost annually to sea level rise alone; McCormick et al., 2021), the settlement and subsequent use by bass of anthropogenically altered habitats is important. Structures, such as breakwaters, can support high juvenile bass densities (Dufour *et al.,* 2009; Pastor *et al.,* 2013; Pizzolon *et al.,* 2008; Ruitton *et al.,* 2000). However, high variation in juvenile bass densities can occur across different artificial habits, with coastal defence structures often having relatively high bass densities versus structures such as man-made harbours (Mercader *et al.,* 2018). Inshore artificial reefs are increasingly used to provide new cryptic habitats for enhancing biodiversity; although, Baited Remote Underwater Video (BRUV) surveys by Hall *et al.* (2021) in Poole Bay, Southern England, suggested bass that used natural versus artificial reefs were larger, but with artificial reefs being identified as important fish habitats more generally (Table 3.2).

3.8.3 Overwintering habitats

In comparison to knowledge on their use of estuarine and inshore habitats, especially in summer by juveniles, there is a paucity of knowledge on the over-wintering habitats of bass. It was alluded to above that as temperatures increase between autumn and winter, the abundance of juvenile bass decreases within the creeks that drain into estuaries, with in-estuary bass abundance then also relatively low across the winter (e.g. Kelley, 1988a; Green *et al.,* 2009).

It is thought that bass are then generally absent from most coastal sites in England and Wales through winter, either due to seeking warmer waters offshore or moving to distant spawning grounds (e.g. Pickett and Pawson, 1994). However, the acoustic telemetry study of Stamp *et al.* (2021) on bass movements in three estuarine nursery areas in southwest England found only 45 % of 133 tagged fish moved outside of their nursery sites during winter. Some of these fish moved to nearby estuaries for the winter, with others considered to have conducted spawning migrations (to locations unknown). The remaining bass were all primarily resident within their nursery areas throughout the winter, never being away for more than six days – including fish considered as sexually mature (e.g. 60 cm length), indicating that at least some bass do not necessarily make long distance spawning migrations every winter (Stamp *et al.,* 2021).

3.9 Ecological interactions

3.9.1 Trophic dynamics

It has already been outlined that saltmarsh habitats in estuaries provide important foraging areas for juvenile bass, with 0-group bass entering salt marshes on flood tides with empty stomachs, feeding mainly on the amphipod *Orchestia gammarellus* for up to two hours before leaving on the ebbing tide with full stomachs (Laffaille *et al.,* 2001; Section 3.8.2). The use of these salt-marsh areas by bass can also vary across the tidal range, where they mainly use them during spring tides (Salgado *et al.,* 2004). Bass movements into these areas are for exploiting prey resources that are also migrating into the creeks for foraging, such as brown shrimp *Crangon crangon* (Cattrijsse *et al.,* 1997).

In general, in estuarine nurseries, juvenile bass are considered as macroinfauna predators (Correia *et al.,* 1997; Pasquaud *et al.,* 2010) that are of relatively high trophic position (Poiesz *et al.,* 2021), with feeding mainly on hyperbenthic and nekton compartments (Pasquaud *et al.,* 2008). Diets comprise high proportions of isopods (e.g. *Synidotea laticauda*) shrimps (e.g. *Palaemon spp*.) and, with increasing length and gape size, small fishes (e.g. *Sprattus sprattus*, *Pomatoschistus spp*., *Solea spp*.) (Pasquaud *et al.,* 2008). In the early settlement period, post-larval bass will feed on copepods, where egg-bearing female copepods are particularly vulnerable to being predated (Mahjoub *et al.,* 2011).

In the Seine estuary, France, 0-group and age 1 year bass consumed isopods and shrimps, but with age 2+ fish diversifying their diet through consuming more benthic prey and fishes, although isopods and shrimps remain primary food sources (Dauvin and Desroy, 2005). In the Schelde Estuary, Belgium, prey resources for all species were sufficient to provide excess food for visiting fish species that then reduced predation pressure on 0-group bass (Hampel and Cattrijsse, 2005). In the Dutch Wadden sea, bass abundance in summer was strongly related to brown shrimp abundance (Cardoso *et al.,* 2015). In some estuaries, the consumption by bass of prey such as brown shrimp means there can be high dietary overlap with other juvenile fishes, although inter-specific competition tends to be avoided through inter-specific differences in habitat use (Cabral and Ohmert, 2001; Coiraton and Selleslagh, 2018).

Notwithstanding the importance of specific prey species to bass diet, considerable individual dietary specialisation has also been observed in juvenile bass. This is despite their bass populations generally being considered as trophic-generalists (Sa *et al.,* 2006). Consequently, their generalist populations are actually composed of relatively specialised individuals that prey mainly on specific items (Cobain *et al.,* 2019). However, in some estuaries, bass diet composition shows little variation between season and estuarine zones, with specialisation on prey resources such as *Gammarus* sp. (Selleslagh and Amara, 2015).

The importance of salt marsh habitats for juvenile bass foraging also makes them vulnerable to disturbance within these habitats. For example, comparison of 0-group bass diet between sheep grazed and non-grazed tidal salt marshes revealed that grazing caused a shift in vegetation to relatively low productivity plant species, impacting the availability and suitability of habitat and food for isopods (i.e. bass prey), with a result of bass switching to consuming other prey that were then ingested in lower quantities (Lafaille *et al.,* 2000). Globally, saltmarsh has declined by approximately 50 %, with comparisons in bass feeding activity between established saltmarsh versus human engineered or re-aligned saltmarsh revealing that feeding rates were 31 % lower in the disturbed marsh, where reduced vegetation density was considered to be important in driving this reduction (Stamp *et al.,* 2023).

Stable isotope analyses (mainly through $\delta^{15}N$, an indicator of trophic position) suggest that even juvenile bass tend to be at relatively high trophic positions in estuarine food webs (Coelho *et al.,* 2013). Such approaches are also able to identify the energy sources of bass (through integrating $\delta^{15}N$ with $\delta^{13}C$), where in the Tejo Estuary, Portugal, the ultimate sources of nutrition of juvenile bass were salt-marsh derived, with *Spartina maritima* being important in diets of the macro-invertebrates that constituted a large proportion of bass diet (França *et al.,* 2011).

These stable isotope approaches also demonstrate some complexity in these estuarine food webs, with multiple fish species having similar isotopic space (and thus dietary resources) but with their exploitation of relatively abundant prey resources in these productive systems generally considered as being unlikely to drive strong competitive pressures. In these estuarine areas, stable isotope studies have also demonstrated low level connectivity between nursery areas (Leakey *et al.,* 2008; Green *et al.,* 2012; Section 3.8), with isotopic distinction between bass captured within estuaries and those captured in coastal areas approximately 40 km away (Vinagre *et al.,* 2011).

It was outlined in Section 3.7 that bass using artificial reefs (ARs) were smaller than those on natural reefs (Hall *et al.,* 2021). Nevertheless, with ARs often acting as fish aggregation devices, prey fish availability can be elevated versus surrounding non-reef areas. Testing the effects of bass predation on the assemblages of fish aggregated on an AR located near a coastal lagoon fish nursery in Portugal revealed that bass predation pressure did increase the natural mortality of their prey populations, but with it suggested that the increased use by bass of these feeding areas then provided opportunities for fishers to increase their fishing yields (Leitao *et al.,* 2008).

When compared with juvenile bass, knowledge of adult bass diet is relatively limited. However, samples collected from pelagic trawl fisheries in the northeast Atlantic indicated that when offshore, bass primarily consume small pelagic fishes, especially mackerel *Scomber scombrus*, scad *Trachurus* spp., anchovy *Engraulis encrasicolus* and sardine *Sardina pilchardus* (Spitz *et al.,* 2013).

3.9.2 Parasites of bass

Most studies on the parasitology of bass have been driven by aquaculture, where the parasite fauna of cultured fish is often low (Mladineo *et al.,* 2010). Wild and cultured bass in the Mediterranean were found to host 13 protozoan parasites, where ectoparasites included ciliates, a dinoflagellate and a zooflagellate, and endoparasites included Apicomplexa, Microsporea and Myxosporea. Three parasite taxa were found only in wild fish and two only in the cultured fish (Alvarez-Pellitero *et al.,* 1993). In the Egyptian Mediterranean Sea, the metazoan parasite fauna of 100 wild bass was assessed, with the parasites detected including seven digeneans, three copepods and two nematode parasites, but with 76 % of all parasites found being the monogenean *Diplectanum aequans* (Abou Zaid *et al.,* 2018).

In the Northern bass stock, 19 parasites were detected infecting 13 wild bass sampled in a fjord in southeast Norway, comprising five protozoans, one monogenean, eight digeneans, one cestode, two nematodes and two crustaceans (Sterud, 2002). In the Lynher Estuary, southwest England, 61 % of examined juvenile bass were infected with the copepod *Lernanthropus kroyeri*, with the gills being the preferred site of attachment, especially the internal face of the medial sector of the posterior hemibranch of the second gill arch (Davey, 1980). Overall, there is no evidence to suggest that parasite infections are major drivers of juvenile or adult bass mortality in the wild.

3.9.3 Bass as prey for piscivorous birds

Although bass are a prey item of cormorants (e.g. great cormorant *Phalacrocorax carbo)*, bass dietary contributions to these birds tend to be low. In the Cabras and Mistras lagoons of Italy, cormorant diet was dominated by species of Mugilidae, with bass of only secondary importance (Buttu *et al.,* 2013). As male cormorants tend to consume larger species than females then they are likely to consume larger dietary proportions of bass, with female cormorants consuming higher proportions of smaller fish species (Liordos and Goutner, 2009). In the Upper Adriatic Sea, bass and gilthead bream (both important aquaculture species) represented only 2 % and 14 % of great cormorant diet by frequency and biomass respectively (Cosolo *et al.,* 2022). Similarly, in cormorant diet in the Sado Estuary (another important aquaculture area), both of these fish species represented only 1.5 % of the fish biomass consumed by the birds (Catry *et al.,* 2017).

Conversely, a mutualistic feeding strategy potentially exists between bass and the European shag *Gulosus artistotelis*, where the corralling of prey fishes by the birds was then exploited by bass to improve their foraging success (Gatti *et al.,* 2021). However, the extent to which this was mutualistic versus opportunistic by bass was unclear, but it was suggested that this represented behavioural imitation by the fish to help them overcome the anti-predator behaviours of their prey (Gatti *et al.,* 2021).

3.10 Impact of climate change and longer-term changes in distribution

3.10.1 Introduction

The bass lifecycle is strongly temperature dependent, especially their early life-stages (Bento *et al.,* 2016). Consequently, it can be assumed that climate warming would strongly influence aspects of their biology and physiology, distribution, and abundance.

The understandings on how oceanographic conditions govern larval recruitment to estuarine nursery areas outlined in previous sections should, thus, help forecast the potential impacts of climate change (Pasquaud *et al.,* 2012; Cabral *et al.,* 2021). Indeed, the ontogenetic habitat shifts and nursery/summer habitat fidelity potentially increases their vulnerability to climate change and overfishing, thus information on the resilience of populations to climate change and their potential distributional shifts northwards is important to consider (López *et al.,* 2015).

3.10.2 **Population resilience to climate change effects**

The influence of climate change on the marine environment is relatively complex, where marine fauna must respond to changes involving the interactions of, for example, warming temperatures, increasing ocean acidification, and altered salinity patterns, along with sea level rises in inshore and especially estuarine areas, including during episodic storm surges (Gissi *et al.,* 2021). The responses (and thus measurements of resilience) of bass to aspects of climate change have been assessed on a wide range of biological and physiological metrics, usually completed in controlled conditions, with many responses suggesting bass populations have some inherent resilience to changing climatic conditions (Table 3.5).

The focus of most studies has been on climate change consequences for bass early-life history. For example, otolith microstructure analyses assessing relationships between hatch day, early life growth and temperature have emphasised the importance of temperature as a driver of recruitment and growth, with an unstable climate having the potential to impact the bass life cycle (Pinto *et al.,* 2021).

The effects of the interaction of ocean acidification and warming on bass larval and juvenile life-stages have revealed that exposure to different levels of pCO_2 (ie. carbon dioxide levels in the blood) had no significant effects on larval growth, development or maximum swimming speeds; whereas warmer temperatures resulted in larvae that grew faster and had deeper bodies (Cominassi *et al.,* 2019). Larval metamorphosis occurred sooner in warmer treatments, but higher swimming abilities were observed in colder water, suggesting a trade-off between fast growth and swimming ability. Thus, while ocean acidification did not compromise these fish, the effects of temperature were marked (Cominassi *et al.,* 2019). However, the exposure of bass to hypercapnia (excess CO_2 in the bloodstream) for five weeks has resulted in slower growth rates, and reduced condition and hepato-somatic index (Alves *et al.,* 2020). From an ecological perspective, the combination of ocean acidification and warming are suggested as potentially decreasing the recruitment of larvae to nursery areas, but once in nursery areas, juveniles might then benefit from increased performance under elevated temperatures (Howald *et al.,* 2022).

Simulations of the effects of heatwaves on juvenile bass growth in coastal and estuarine nurseries have indicated that in heatwave conditions (28 °C), growth rates are reduced (0.16 mm d^{-1}) versus ambient inshore (18 °C; 0.20 mm d^{-1}) and estuarine (24 °C; 0.34 mm d^{-1}) conditions, with a similar pattern detected in body condition (Vinagre *et al.,* 2012a). Mortality rates were also lowest, and metabolic rates optimal, at 24 °C. Therefore, prolonged periods of extreme heat could have negative effects on bass biology and metabolic ecology in estuarine nurseries (Vinagre *et al.,* 2012b).

When juvenile bass are unable to feed *ad libitum* then the impacts of the interaction of ocean acidification and warming can be more severe. For example, in an experimental treatment at 15 °C, juvenile growth rates increased with food ration size, with pCO_2 having no effect; whereas, in an experimental treatment at 20 °C, acidification and warming acted antagonistically, where increased temperature and pCO_2 combined to produce reduced feeding levels and growth (Cominassi *et al.,* 2020).

In summary, the population resilience of bass to climate change varies according to the metrics and changes being measured, with ocean acidification (at least levels in the near future) appearing relatively benign, but with interactions with elevated temperatures, especially episodic heatwaves, potentially impacting juveniles in estuarine nursery habitats.

3.10.3 **Distribution shifts of bass in response to climate change**

Information on the distributional shifts of bass in relation to climate change is limited, but with evidence of new bass fisheries being established in the early 2000s in response to their increasing northern distribution (MMCIP 2010), although the extent to which these fisheries were established through climate change distributional changes versus the increased stock biomass resulting from the strong recruitment of 1989 and the early 1990s is not clear.

Nevertheless, given that (i) bass life history and lifecycle is driven largely by temperature, and (ii) bass is generally considered a relatively warm water species, with their Atlantic populations towards the edge of their northern range, then this suggests that their 'climate envelope' and distribution has some scope to move northwards by a considerable distance. The inshore and estuarine distribution of the species in summer suggests it is less likely to seek deep, cooler waters in these periods. However, there have been warnings against over-emphasising the extent to which climate change will drive changing marine fish distributions more generally (e.g. Brander 2018), with suggestions that bass will expand their northerly distribution now considered to be less probable than previously (Pinnegar *et al*., 2020).

Table 3.5. Some biological and physiological responses of juvenile bass to aspects of climate change (OA: Ocean Acidification; WT: Warming Temperatures).

Effect	Effect measured	Response	Reference
OA	Behaviour: left vs right turning preferences	Near future OA does not affect the number of turns or turning preference	Jarvis *et al.,* 2022
OA	Responses to drug exposure	Toxicity of pharmaceuticals to bass could be elevated by warming	Maulvault *et al.,* 2017
OA	Movement	Juvenile bass reared under ambient conditions, OA conditions, and reared in ambient conditions but tested in OA water all revealed similar movement patterns and reacted to their environment and interacted with each other in comparable ways, indicating behavioural resilience to near-future OA.	Duteil *et al.,* 2016
OA x Ammonia	Eco-physiological performance	Adverse effects of single exposures of ocean acidification or ammonia are exacerbated when present together, with bass more vulnerable to both stressor at low salinities.	Shrivastava *et al.,* 2019
Elevated CO_2	Olfaction	Bass olfactory system and central brain function are compromised by elevated CO_2 levels (e.g. fish must be up to 42 % closer to odour for detection at elevated CO_2).	Porteus *et al.,* 2018
WT	Otolith shape	Otilith shape is very sensitive to environmental temperature and can be effective at identifying stocks exposed to different temperature regimes	Mahe *et al.,* 2019
WT	Gut biome	Increasing temperatures induce significant changes in the gut microbiota and metabolism of juvenile bass	Liu *et al.,* 2022
WT	Fatty acid (FA) and elemental composition of muscle and liver	Higher saturated FA levels in muscle and lower in liver in warmer temperatures; warming promoted changes in elemental profiles; neither change was considered as detrimental to human health	Barbosa *et al.,* 2017
WT	Sperm production (quality and quantity)	Winter heatwaves could have moderate effects on male reproductive performance through reduced sperm production rates, but with no change in sperm quality.	Geffroy *et al.,* 2023
WT	Neuronal functions	Environmental temperatures influence bass behaviour and central nervous system neurochemistry	Manciocco *et al.,* 2015
WT x Diet	Growth	Juvenile bass can implement physiological mechanisms to cope with decreased dietary omega-3 polyunsaturated fatty acids in their diet that enables their faster growth at higher temperatures, but with some of the metabolic costs sill needing evaluation.	Gourtay *et al.,* 2018
WT x OA	Respiratory capacity of heart mitochondria	Bass maintained mitochondrial function under OA conditions, with improved mitochondrial energy metabolism after warm conditioning, indicating high environmental tolerance and that bass in more northern waters potentially benefiting from warming temperatures.	Howald *et al.,* 2019

Effect	Effect measured	Response	Reference
WT x Salinity	Hemato-physiological and molecular responses to extreme warming	Limited acclimation capacity to extreme warming across four salinity groups, but with acclimatisation of bass at salinities of 12 psu and 6 psu salinities, better able to cope with expose to temperatures of 33 °C.	Islam *et al.,* 2020
WT x Salinity	Acclimation to freshwater incursions to estuaries.	High capacity for acclimation to changes in salinity and temperature, with salinity changes having stronger effects , which could influence future use of estuarine areas.	Trancart *et al.,* 2016

4. REVIEW OF BASS FISHERIES

4.1 Introduction

4.1.1 Bass stock units

Unlike many other exploited marine fishes, bass are not subject to total allowable catches and quotas, and so their management is applied through a mixture of catch limits, technical measures and seasonal closures (ICES 2012a,b; European Commission, 2015; UK Parliament, 2016), with these limits, measures and closures reviewed annually (Section 4.3). These limits, measures and closures are informed by advice provided by ICES, who currently recognise four bass stock units for the Atlantic, but with benchmarking exercises due to the near future where this will be reviewed (e.g. comparison of the stock units versus the stock genetic structure) and thus will potentially be altered (Figure 4.1):

1. Northern, comprising of fish in the central and southern North Sea, Irish Sea, English Channel, Bristol Channel and Celtic Sea. These are known as ICES divisions 4.b-c, 7.a and 7.d-h.
2. Biscay, comprising of fish in the northern and central Bay of Biscay; known as ICES divisions 8.a-b)
3. West of Scotland and Ireland, known as ICES divisions 6.a, 7.b, 7.j
4. Atlantic Iberian, known as ICES divisions 8.c and 9.a.

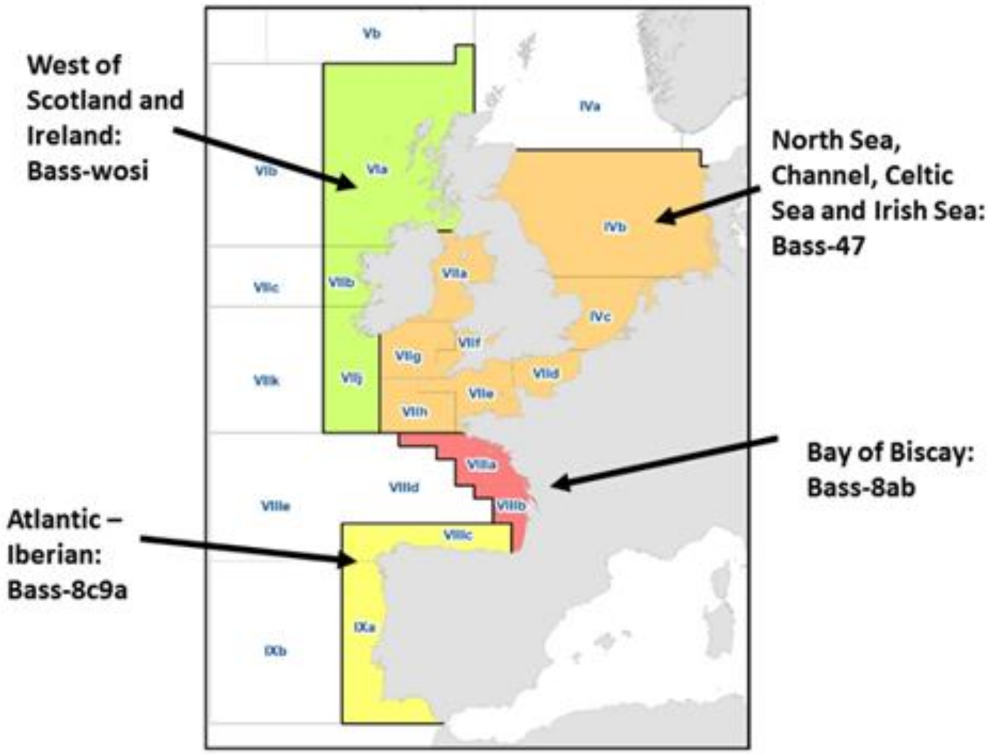


Figure 4.1. The four stock units of bass recognised by ICES (from ICES, 2022b), where the North Sea, Channel, Celtic Sea and Irish Sea comprise the Northern stock.

4.1.2 ICES catch advice

ICES catch advice is provided for all stocks, but with assessments only run for the Northern and Biscay bass stocks. The focus in the remainder of this section is on the Northern stock, but with some comparisons made to the Biscay stock. For assessment purposes, the Northern stock is assessed by the Working Group for the Celtic Seas Ecoregion (WGCSE) and the Biscay stock by the Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE).

The stock units are determined by ICES at benchmark exercises based on a combination of studies that can inform the existence of biological units, where the most recent benchmarking exercise was started in 2022. In providing their advice, ICES receive fisheries dependent and independent data from national authorities, with the bass dataset running since 1985, but with other data on bass stocks not currently included (Appendix 2). These data are then used in an assessment model (Stock Synthesis, SS3 hereafter) for each stock, with the output providing estimates of a range of population and fishery-based metrics (Table 4.1, Section 4.3). Definitions of terms used in bass fishery stock assessments – and so throughout this section - are provided in Table 4.1.

Table 4.1. Terms and definitions used in bass stock synthesis models and that have relevance to stock assessments outlined in this section of the report.

Term	Definition
SS3	Stock Synthesis (SS3): a size and age-structured population dynamics model that is used to estimate stock sizes and fishing pressure
SSB	Spawning stock biomass. Total weight of all sexually mature fish in the stock.
SSB_{MP}	Spawning stock biomass reference point as defined in management plans
MSY	Maximum Sustainable Yield: largest average catch or yield that can continuously be taken from a stock under existing environmental conditions without negatively affecting the stock health
MSY $B_{trigger}$	A biomass reference point that triggers a cautious response within the ICES MSY framework
BMSY	Spawning stock biomass (SSB) that results from fishing at F_{MSY} for a long time.
B_{lim}	Limit reference point for spawning stock biomass (SSB)
B_{pa}	Precautionary reference point for spawning stock biomass (SSB)
$B_{trigger}$	Value of spawning stock biomass (SSB) that triggers a specific management action
Discards	Those components of a fish stock thrown back after capture e.g. because they are below the minimum landing size or because quota has been exhausted for that species. Most of the discarded fish will not survive.
F	Instantaneous Rate of Fishing Mortality. F = 0.5 means that 1-EXP(-0.5) = 39% of the population is removed by fishing.
F_{pa}	Precautionary reference point for fishing mortality (mean over defined age range)
F_{lim}	Limit reference point for fishing mortality (mean over defined age range)
FMSY	Fishing mortality consistent with achieving Maximum Sustainable Yield (MSY)

4.1.3 Relationships of fishing metrics used in fishery assessment models

Given the importance of the fishery-based metrics relating to stock biomass and fish catches for fisheries management (Table 4.1), it is important to understand their inter-relationships and what these mean in terms of stock levels and the sustainability of fishing. This can be looked at in two ways, at the stock level and at the fishing mortality level.

At the stock level, achieving MSY needs SSB to be kept above the biomass action points of MSY $B_{trigger}$ and/or B_{pa}. In contrast, the Precautionary Approach aims to keep the stock at a level where removals from fishing do not affect reproduction (when fishing affects recruitment, 'recruitment overfishing' occurs). The relationship between SSB and these fishing metrics are outlined in Figure 4.2, where at high SSB, the stock can potentially be exploited at MSY where it will be at its most productive in growth and reproduction (i.e. B_{MSY}). As fishing pressure increases, SSB reduces until it is eventually below B_{lim}, where there is insufficient reproductive capacity to produce enough recruits to sustain the fishery, i.e. the stock is now outside of safe biological limits and risks collapse (Figure 4.2). However, as there is considerable uncertainty in SSB estimates, the stock is considered at risk when it is below B_{pa} and $MSYB_{trigger}$. These are, thus, action points at which it is expected measures are taken to reduce fishing mortality that aim to exploit the stock at MSY (Figure 4.2).

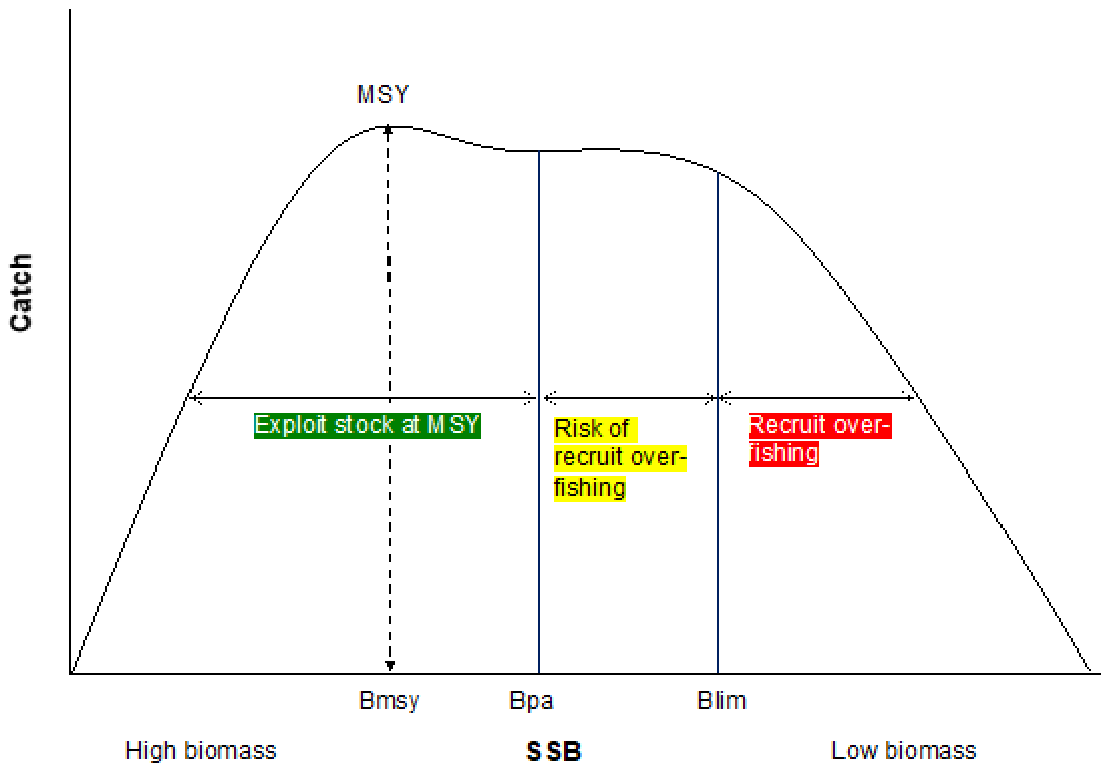


Figure 4.2. Relationship of Spawning Stock Biomass (SSB) and fish catch according to BMSY, $MSYB_{trigger}$ and B_{lim}, adapted from Lart (2015) (Table 4.1).

Bass mortality (Z) comprises natural mortality (M) and fishing mortality (F) and, thus, F can be managed to regulate Z (as M cannot be managed). There is a relationship between F and SSB, including key reference points of SSB (Figure 4.3). Correspondingly, when a stock is exploited at a constant F then the stock will, in the long-term (so allowing for environmental stochasticity impacting recruitment success), be at a constant SSB level (Figure 4.3).

Accordingly, when SSB is being reduced by excessive F, the trigger points of B_{pa} and $MSYB_{trigger}$ indicate the points when F must be reduced (Figure 4.3). At high stock biomass, at equilibrium, catches increase proportionally as F increases, until the stock reaches MSY after which increasing mortality results in excessive fish of relatively small size being removed from the population – leading to "growth overfishing" (Figure 4.3).

Stock collapse can then occur if F increases beyond F_{lim}, which is the level of F where the spawning capacity of the stock is lowered to the point where reduced recruitment occurs. The result is then, potentially, a vicious circle of higher exploitation coupled with reduced recruitment – "recruit overfishing" (Figure 4.3). Thus, the catch limits, technical measures and seasonal closures of bass fisheries, implemented since 2015, aim to maintain F at levels where SSB is sustainable and the population is not at risk of collapse.

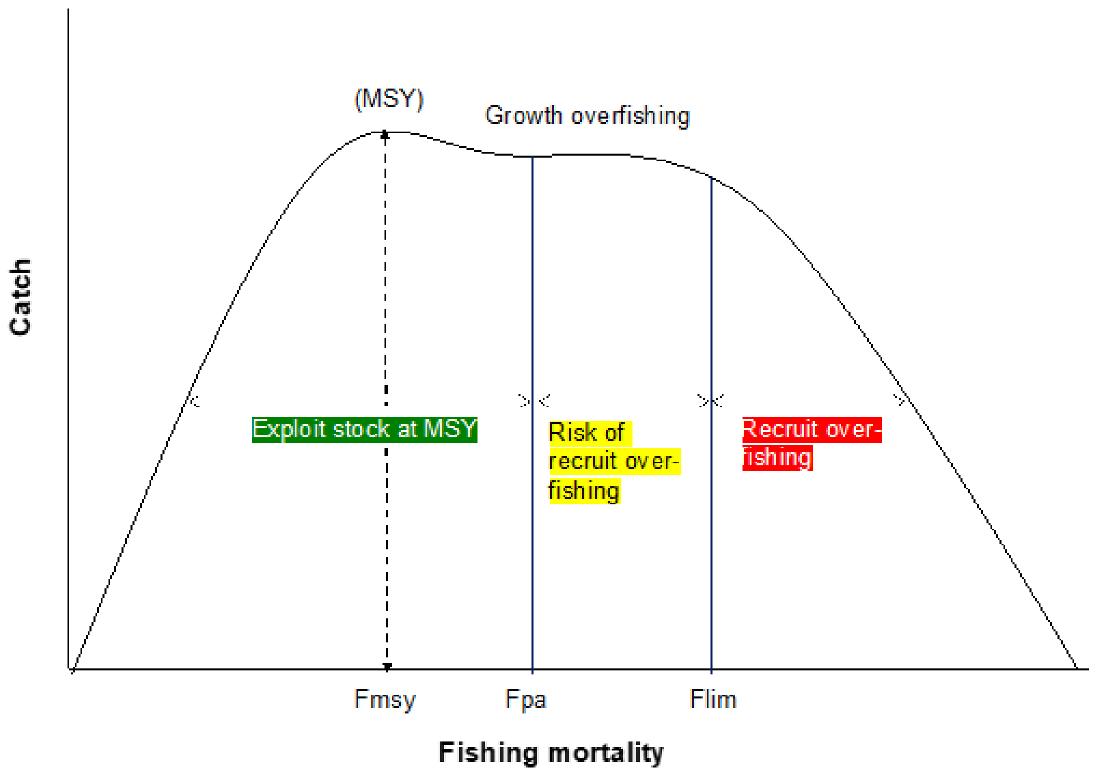


Figure 4.3. Relationship of fishing mortality and catch according to FMSY, F_{pa} and F_{lim}; adapted from Lart (2015) (*cf*. Table 4.1).

4.1.4 Bass management measures since 2015

Due to declines in bass SSB (Section 4.3), fishing for bass has been prohibited since 2015, but with derogations for commercial and recreational gears, and with the minimum conservation reference size (MCRS) increasing from 36 to 42 cm. Following annual ICES stock assessments in SS3 (Section 4.3), the corresponding catch advice is allocated between the commercial and recreational sectors, where the allocation of catches in both sectors involve closed periods. In 2020 to 2022, these were:

- Commercial: February and March: No landings.
- Recreational: January, February and December: catch and release angling only.

The recreational fishery is managed by bag limits between March and November, where between 2020 and 2022, a maximum of two fish per day above the MCRS were allowed to be taken. Catch allocations in the commercial sector are split between demersal trawls, seines, hooks and lines and fixed gillnets (Table 4.2).

Table 4.2. Catch allocations in the commercial bass (Northern stock) fishery by method, 2020 to 2022 (ICES, 2022a,b).

	Demersal trawls	Seines	Hooks and lines	Fixed gillnets
2020	< 520 kg / 2 months < 5 % total catch / day	< 520 kg / 2 months < 5 % total catch / day	5.7 t / year	1.4 t / year
2021 Jan 21, 01/04/21 – 31/12/21			5.7 t / year	1.4 t / year
2021 Jan 21, 01/04/21 – 31/07/21	< 520 kg / 2 months < 5 % total catch / day	< 520 kg / 2 months < 5 % total catch / day		
2021 01/08/21 – 31/12/21	< 380 kg / month < 5 % total catch / day	< 380 kg / month < 5 % total catch / day		
2022	< 760 kg / 2 months* < 5 % total catch / day	< 760 kg / 2 months < 5 % total catch / day	5.95 t	1.5 t

*2 months: January/April; May/June; July/August; September/October; November/December

4.2 Commercial and recreational fisheries catches (landings and discards)

A fundamental component of ICES stock assessment and advice (Section 4.1) is data on bass catches in both commercial and recreational fisheries. Patterns of catches in both of these fisheries in the Northern bass stock are outlined below.

4.2.1 Commercial fisheries catches

Exploitation of the Northern bass stock historically comprised of an offshore fishery that targeted pre-spawning/spawning from November to April, primarily by French and UK pelagic trawlers, and relatively small-scale fisheries that targeted fish in coastal areas following spawning.

Since 2015, when new management measures were implemented (Section 4.1, 4.6), the pelagic trawl fishery can no longer target bass migrating to spawning grounds, leaving the principal commercial exploitation as inshore fishing based on hook and line, trawls, and fixed gillnets.

The implementation of management measures in 2015 was in response to declines in catches and SSB from 2010 (Figure 4.4; Section 4.7).

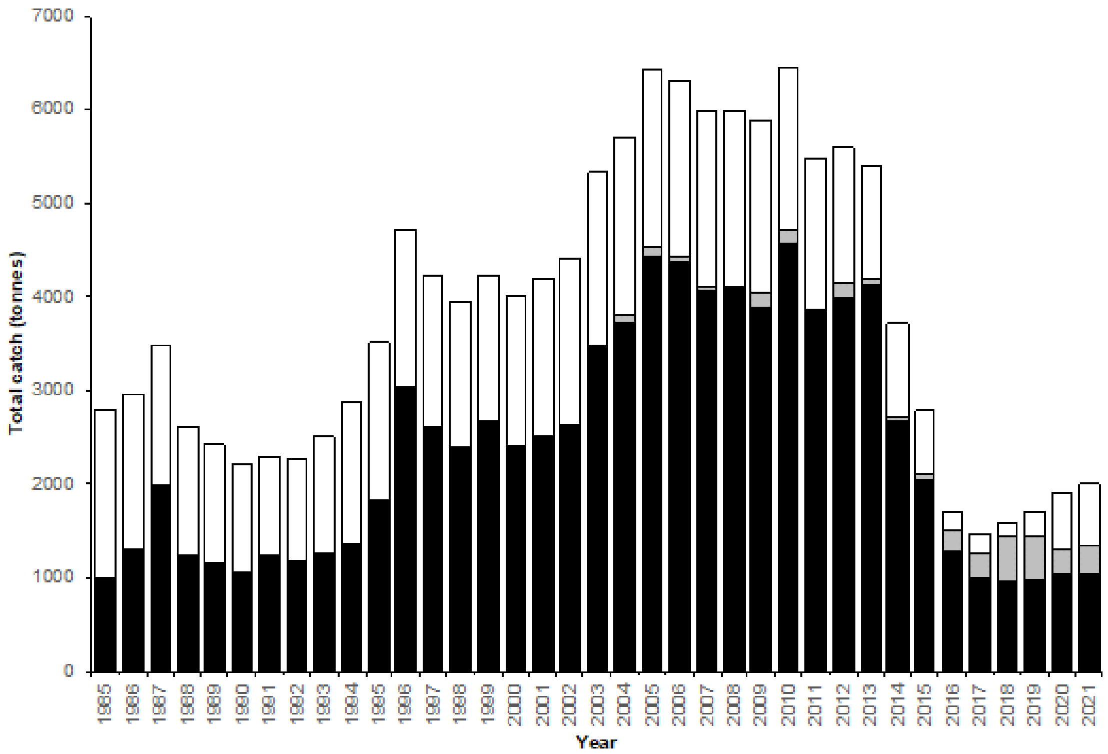


Figure 4.4. Total catch of bass per year and sector in the Northern stock, 1985 to 2021. Black: Commercial landings; Grey: Commercial discards; Clear: Recreational angling removals (ICES, 2022b).

Historical bass landings in the commercial sector peaked in the 2000s, following increases from the mid-1980s (highest landings: 4,562 tonnes in 2010). These increases were due to a combination of strong recruitment from the year classes of 1989 and in the early 1990s (Figure 3.6) and increased fishing effort. Between 2011 and 2014, however, annual landings reduced by 41 % due to the interaction of weak year classes and higher fishing mortality. Since the implementation of the new management measures in 2015 (Section 4.7), landings have remained below the MSY target and much reduced from their 2010 peak (Figure 4.4).

The commercial bass landings recorded by ICES in 2021 was 1,126 t, with 412 t discarded (ICES, 2022b). Hook and line methods were responsible for 46 % of landings, fixed nets 24 %, and bottom trawlers 21 %. Preliminary ICES data for 2022 include landings of 1,275 t (France: 385 t, UK: 613 t, Netherlands 231 t; Channel Islands 1 t (ICES, 2022b). Note that more information on commercial discards is provided in the following section.

The catch landings provided here have the caveat that there has, historically, been considerable potential for the under-reporting of landings by smaller vessels, given logbook catch recording schemes have only recently been implemented. This means vessels with relatively small catch proportions would have not been captured in catch statistics.

4.2.2 Discard rates and survival

Commercial discard data have been included in ICES Northern stock assessments since the early 2000s, where they have contributed a mean of 8 ± 5 % of total commercial catch, but with a peak in 2018 at 34 % (Figure 4.4). In the UK commercial hook and line fishery, a questionnaire survey of practitioners suggested that the mean discard rate is approximately 13 %, with reported rates of foul and deep hooking being low, and with air exposure of discarded fish also suggested as low (where prolonged air exposure can be highly damaging to fish that are subsequently released) (Lamb *et al.,* 2022). Data on discard rates remain limited due to their collection only during observer programmes that are limited in number and cover a wide range of vessels and fishing fleet diversity.

Discard rates are driven by a number of factors, including the proportion of catch comprising bass that can be kept, and the relationship between current Minimum Conservation Reference Size (MCRS; i.e. minimum landing size) and gear selectivity. For example, prior to the altered bass MCRS from 36 to 42 cm in 2015 (Section 4.7), Walmsley and Pawson (2007) investigated differences across trawl mesh sizes in discard rates in English coastal fisheries. Trawlers in the eastern English Channel captured a very narrow bass size range, catching a relatively high proportion of fish < 36 cm, with many also < 40 cm; whereas, North Sea trawlers captured a wider range of size classes. Trawlers using 80 and 90 mm mesh nets caught higher proportions of undersized fish than those using 100 mm mesh, but 20 % of bass captured in 100 mm mesh were < 40 cm (Walmsley and Pawson, 2007). In the North Sea, gill nets of 90 mm mesh size had a peak size selectivity of 41 – 44 cm, whereas this selectivity increased to 54 – 58 cm in 120 mm mesh sizes (Revill *et al*., 2009). Thus, catches of fish smaller than the MCRS can be reduced through using more selective gears, but with the caveat that in mixed fisheries, this is likely to reduce catches of other fishes. However, such measures will not reduce discard rates where the driver of discarding is connected with the percentage cap per trip of bass that can be landed.

Survival rates of discarded bass have been assessed for their vitality following capture in drift nets, static nets and otter trawls. Fish vitality on release - as their ability to maintain body equilibrium - was higher for fish captured in drift nets versus otter trawls, with the lowest values for bass captured in static nets (Randall *et al.,* 2021). The pattern differed for at-vessel mortality rates where otter trawls resulted in 7 % mortality compared with 12 % in drift nets and 68 % in static nets.

Drift netting consistently resulted in fewer injuries than other methods, with almost half of fish having no visible external injury versus approximately 30 % in static nets and < 10 % in otter trawls. However, DST tagging suggested overall survival rates were low across all discards, where the precautionary management principle would be an assumption of negligible discard survival (Randall *et al.,* 2021). This is in contrast with the hook-and-line fishery, where a captive experiment suggested a UK fleet-wide discard survival rate of 89 % (Lamb *et al.,* 2022).

4.2.3 Recreational catches, including survival of released fish

Bass is a well-established target species for recreational anglers (Armstrong *et al.,* 2013; Hyder *et al.,* 2020, 2021). Recreational fisheries have been estimated to take around 27% of the total recreational and commercial removals (Hyder et al., 2018; Radford et al. 2018). Catches in recreational fisheries are estimated at the country level, where historical catch data are limited with, for example, 2012 catches based on estimates using combined data from national survey instruments (ICES, 2018; 2022a,b). Data collected through surveys also only generate length information, not age structure.

It is important to note that many recreational anglers adopt catch and release practices, where all fish are returned alive (mandatory for fish < 42 cm), with release rates of angler captured bass already being relatively high prior to 2015 (e.g. 77 %; Ferter *et al.,* 2013). Release rates in 2016 and 2017 were at least 80 %, with released fish generally being smaller than kept fish (Hyder *et al*., 2020). Post-release mortality is also low overall, with experimental work suggesting mean mortality rates across all methods and countries being 5.0 % (95 % confidence interval: 1.7 to 14.4 %) (Lewin *et al.,* 2018). Moreover, there were considerable differences between methods, with no mortality observed in fish captured using artificial baits, whereas natural baits resulted in 13.9 % mortality due to issues including deep hooking and prolonged air exposure (Lewin *et al.,* 2018). The sub-lethal effects of catch and release bass angling on energy budgets are also considered as low versus energy intake from assimilated food (Watson *et al.,* 2022a).

In French recreational fisheries, Rocklin *et al.* (2013) estimated that total angling catch was 3,173 t, with 2,345 t retained, representing 30 % of the commercial catches on the French Atlantic coast. This figure is relatively consistent with estimates from the Northern stock that suggest removals by the recreational fishery (harvested fish plus those that are returned but die) across all relevant countries was approximately 27 % of total removals (Hyder *et al.,* 2018; Radford *et al.,* 2018). Bass removals by recreational fisheries are, thus, included in ICES assessments, with estimates in 2021 of 489 t of bass being removed, representing approximately 25 % of the total catch (ICES, 2022a, b), but with these figures being substantially lower than figures prior to 2012 (Figure 4.4).

4.3 Stock assessment

ICES consider bass as a Category 1 stock, which means it is a data rich stock for which a full analytical assessment is conducted and catch scenarios are provided for a range of fishing mortality (F), considering both precautionary approach and MSY reference points, as well as the EU multiannual management plan (Section 4.1, Table 4.1, Figure 4.3). ICES fishing opportunity advice is according to the ICES MSY approach. For example, recent advice (ICES, 2021):

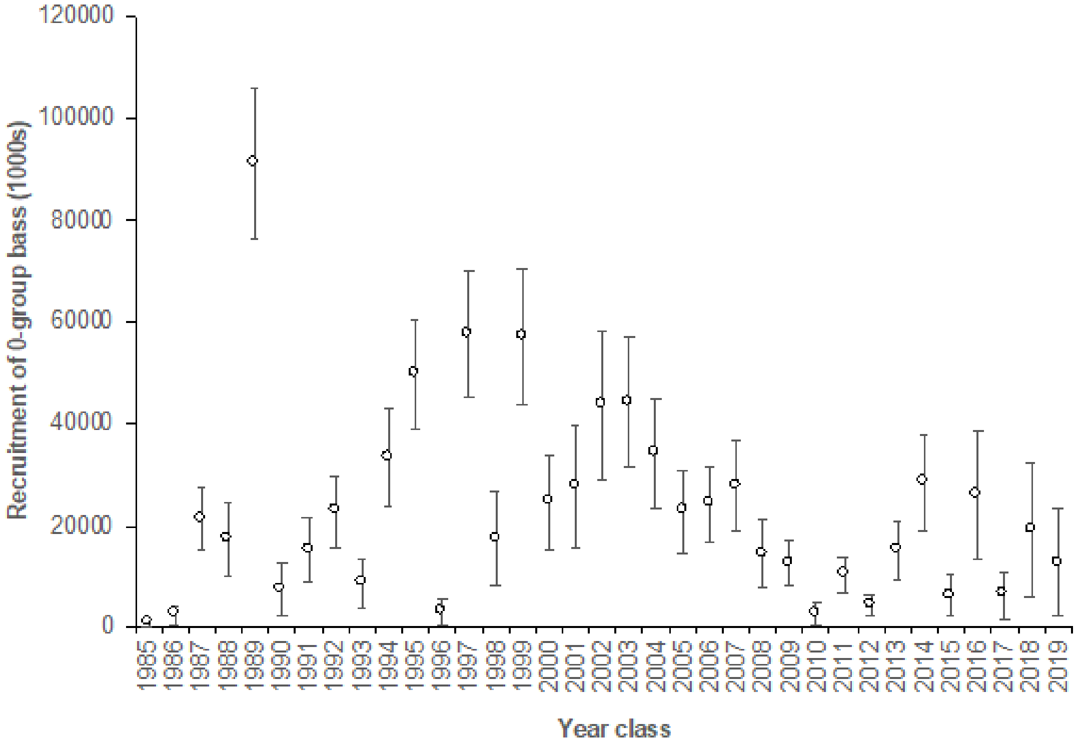
"ICES advises that when the MSY approach is applied, total removals in 2022 should be no more than 2216 tonnes. ICES notes the existence of a precautionary management plan, developed, and adopted by some of the relevant management authorities for this stock."

The basis of the model is annual data on commercial landings and discards, recreational removals as well as survey data that are used to help tune the model, with length and age frequency data where they are available. The predictions are stock-specific (i.e. Northern, Bay of Biscay) and are for the combined sexes. For the Northern stock, the model defines six fleets: UK bottom trawls and nets; UK lines; UK midwater trawls; French combined fleets; other (i.e. other countries plus other UK fleets combined); recreational fisheries. The life history trait data that are used in the model are summarised in Table 4.3.

Table 4.3. Overview of SS3 key life history trait parameters entered for the Northern bass stock used in the WGCSE 2021 assessment.

Characteristic	Settings
Start/ end year	1985/2021
Individual growth	von Bertalanffy, parameters fixed, combined sex
Maximum age	30
Maturity	Logistic 2 -parameter – females; L50 = 40.65 cm
Weight–length coefficient (a)/ exponent (b)	0.00001296 / 2.969
Maturity inflection (L50%)	40.65 cm
Maturity slope	-0.33
Length-at-age Amin	19.6 cm at Amin=2
Length-at-Amax	80.26 cm
von Bertalanffy k	0.097
von Bertalanffy Linf	84.55 cm
von Bertalanffy t0	-0.73 yr

The model fitting process leads to the calculation of the parameters which will minimise the difference between observed and predicted abundance indices, length and age distributions (both fisheries-independent and dependent). The fitted model produces estimates of stock numbers (or biomass) at age, fishing mortality at age, and recruitment from 1985 to present. Recruitment and SSB estimates are provided in Figure 4.5, with selected data from 2000 onwards also provided in Table 4.4.



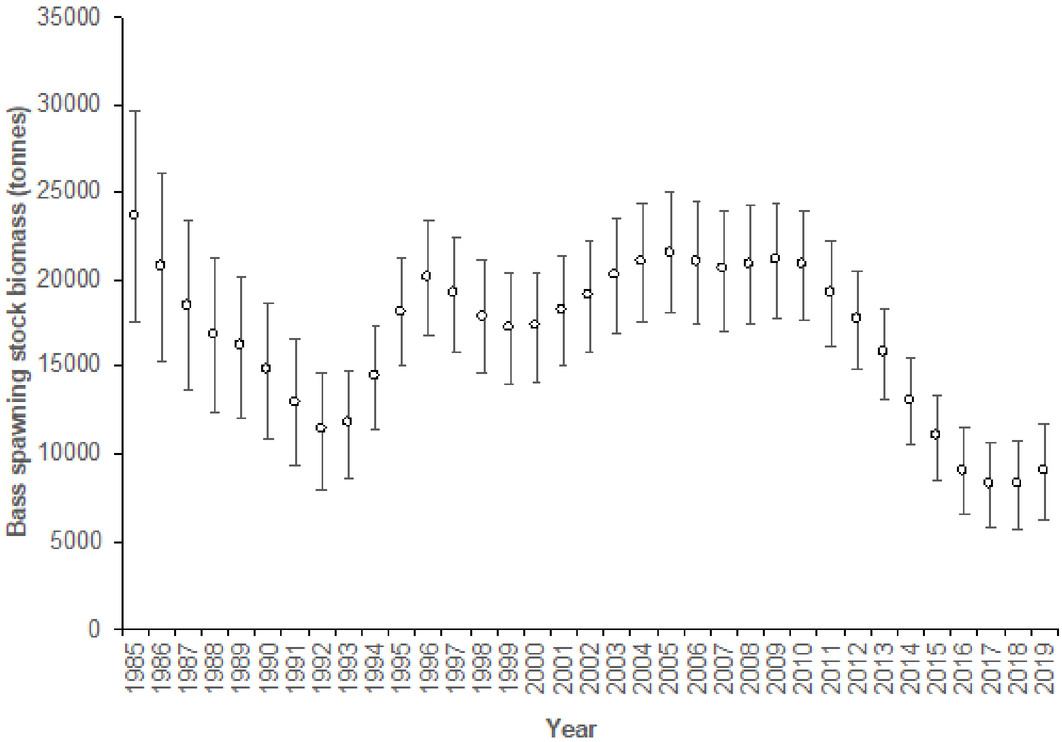


Figure 4.5. Top: Recruitment of bass in the Northern stock, 1985 to 2019; Bottom: Spawning Stock Biomass (SSB) of bass, 1985 to 2019. Both estimated from the 2021 SS3 simulation (ICES, 2022a,b).

Table 4.4. ICES advice and corresponding catch and discard data for the Northern bass stock, where all weights are in tonnes (ICES, 2022a,b).

Year	ICES advice	Catch corresponding to advice*	Official commercial landings	ICES commercial landings	ICES commercial discards^	ICES recreational removals
2000	-	-	2100	2407		
2001	-	-	2200	2500		
2002	No increase in effort or F	-	2400	2622	17	
2003	No increase in effort or F	-	2900	3459	16	
2004	No increase in effort or F	-	3000	3731	59	
2005	-	-	3200	4430	96	
2006	-	-	3396	4377	53	
2007	-	-	3521	4064	50	
2008	-	-	3027	4107	8	
2009	-	-	4288	3889	151	
2010	-	-	4952	4562	148	
2011	-	-	4183	3858	22	
2012	No increase in catch	-	3982	3987	157	1440
2013	20% reduction in catches (average of the last three years)	< 6000**	4243	4137	53	
2014	36% reduction in commercial landings (20% reduction, followed by 20% precautionary reduction)	< 2707**	2816	2682	25	
2015	MSY approach		2081	2066	40	
2016	MSY approach	<115*** ≤541*** 0	1300	1295	199	
2017	Precautionary approach		1027	984	271	
2018	MSY approach	≤ 880^^^	931	948	482	
2019	MSY approach	≤ 1806^^^	970	972	464	
2020	Management plan	1634–1946^^^	1150^^	1042	325	
2021	Management plan	2000 (range 1680–2000) ^^^	1275^^	1126	412	
2022	MSY approach	≤ 2216^^^				
2023	MSY approach	≤ 2542^^^				

* Advice prior to 2014 was provided for sea bass in the Northeast Atlantic. ** Commercial landings. *** Total landings (commercial and recreational landings). ^ Incomplete for some fleets 2002-2008. ^^ Preliminary. ^^^ Includes commercial catch and recreational removals (taking mortality of released fish into account, estimated at approximately 5%).

In the last reported SSB estimation, where 2021 was set as the final year of data, the increased biomass in the 1990s was driven by very strong recruitment of the 1989 year class, plus some strong subsequent year classes that followed a period of poor recruitment (Figure 4.5). More recent SSB declines were coincident with a series of weak year classes since 2008, coupled with higher F than estimated for the 1980s. Estimated SSB has been increasing slightly since 2018, with reasons speculated as a combination of new management measures implemented from 2015 and some improved recruitment since 2013 (ICES, 2022b). The latest reference points for SSB and F related metrics are provided in Table 4.5.

Table 4.5. Reference points for the commercial fisheries of the Northern bass stock in 2022 (cf. Table 4.1 for definitions of metrics; Fig. 4.2 and 4.3 for relationships between the metrics).

Precautionary Approach	
B_{lim}	10313 t
B_{pa}	14439 t
F_{lim}	0.25
F_{pa}	0.20
MSY Approach	
F_{MSY}	0.17
F_{MSY} lower	0.14
F_{MSY} upper	0.17
MSY Btrigger	14439 t

4.4 Predictive modelling to complement stock assessment

Statistical models can provide predictions that, in future, could help provide catch advice following forecast at the fleet level. While the catch advice is currently for total removal, the management measures requires some understanding of the impact of different measures on different fleets on the resulting total removal. This is where predictive models can provide new insights through running different management scenarios. However, this link does not yet exist.

4.4.1 Individual Based Models (IBMs)

Individual Based Models (IBMs) simulate individual 'agents' of organisms that interact with each other and their environment locally and have been used widely in ecology and conservation management in the last decade (e.g. Phang *et al.,* 2016; Dominguez Almela *et al.,* 2021). Although traditional fishery models rely on using habitat suitability as an important determinant of the spatial distribution of a fish stock, this assumes that all individuals respond in a similar manner to the habitat and have similar dispersal capacities. However, this is increasingly being challenged, with many species demonstrating high individual variability in traits and behaviours. IBMs overcome these issues by explicitly simulating the movement of individuals within a modelling framework, where populations are represented by constituent individuals in spatially explicit landscapes (i.e. the landscape is separated into patches and cells of homogenous habitat), with the population dynamics and structure of the population emerging from the actions of all individuals (Grimm and Railsback, 2005). IBMs can incorporate population dynamics, as per the SS3 stock assessment model (Sections 4.1, 4.3), but in IBMs these dynamics can be size-, age- and individual-based, accounting for individual variability (Walker *et al.,* 2020).

Simulations of the population dynamics and spatial distribution of the Northern bass stock were run in a spatially explicit IBM that was developed with the model landscape consisting of dynamic maps of sea surface temperature, due to its influence on bass growth, movement, migrations and spawning (*cf*. Section 3). Bass spatial distribution was simulated using a combination of known temperature preferences and extant tagging studies (Section 3.4). Population dynamics were based on conventional stock assessment techniques and conditioned on SS3 parameterisations for the Northern stock (Sections 4.1, 4.3; Walker *et al.,* 2020). Model simulations under different projections of constant F, revealed that, over a 35-year future forecast simulation, median SSB equilibrated after approximately 25 years in all F scenarios. Even under reductions in F, management scenario trajectories suggested an initial time lag in SSB recovery due to weak recruitment, but improved recruitment thereafter impacted the spawning stock in 2021; from then, SSB increased to equilibrium in all cases, but at higher levels of SSB at F = 0. Simulations then indicated that setting commercial limits would be the most effective strategy for short-term rebuilding of SSB, with increasing the MCRS from 36 cm to 42 cm the more effective strategy in the longer-term (Walker *et al.,* 2020; Section 4.7).

The IBM of Walker *et al.* (2020) was developed further to produce a spatio-temporally explicit IBM in which individual fish responded to local food supply and sea surface temperature (Watson *et al.,* 2022a). A mechanistic link between observed local food supplies (driven by phytoplankton density) and sea surface temperatures and overall bass population dynamics was predicted (Watson *et al.,* 2022a).

4.4.2 Simulating catch allocations

ICES has started developing an allocation tool for the Northern stock of bass catches to test management scenarios for commercial fishing (annual or monthly individual limits by trade) and for recreational fishing (daily individual limit per period), using ICES sampling recommendations. This can be accessed at: https://github.com/ices-taf/2019_bss.27.4bc7ad-h_catchAllocationTool-for-2020. It is currently not used in management and is still in development, but is being explored to support allocation and the setting of management measures across different fleets.

The tool allows one catch option ($F_{MSY} \times SSB_{2023}$ / $MSYB_{trigger}$), time steps of either monthly or annual, different management options to be set for the recreational fishery, and inputs of vessel catch allocation by gears (tonnes per vessel) (Figure 4.6).

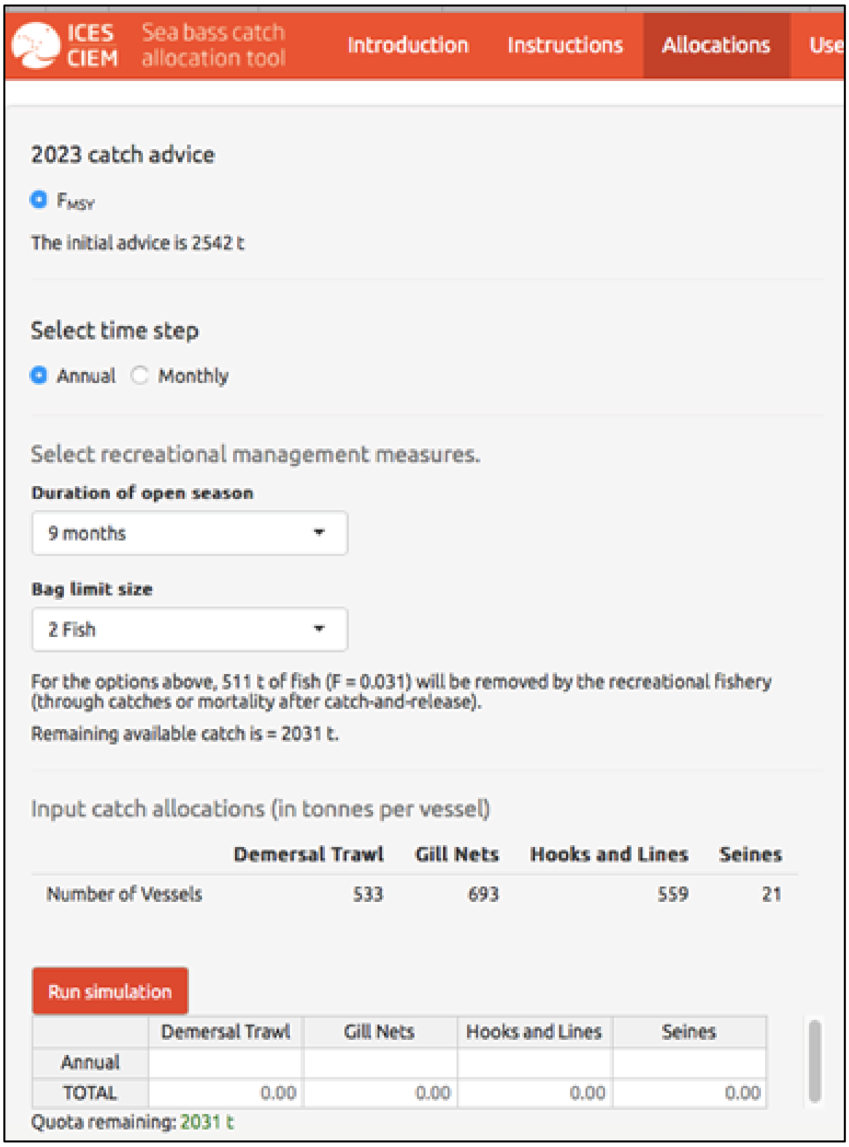


Figure 4.6. Inputs into the 'Sea bass catch allocation tool', where the 2,542 t initial advice is the ICES advice (*cf*. Table 4.4).

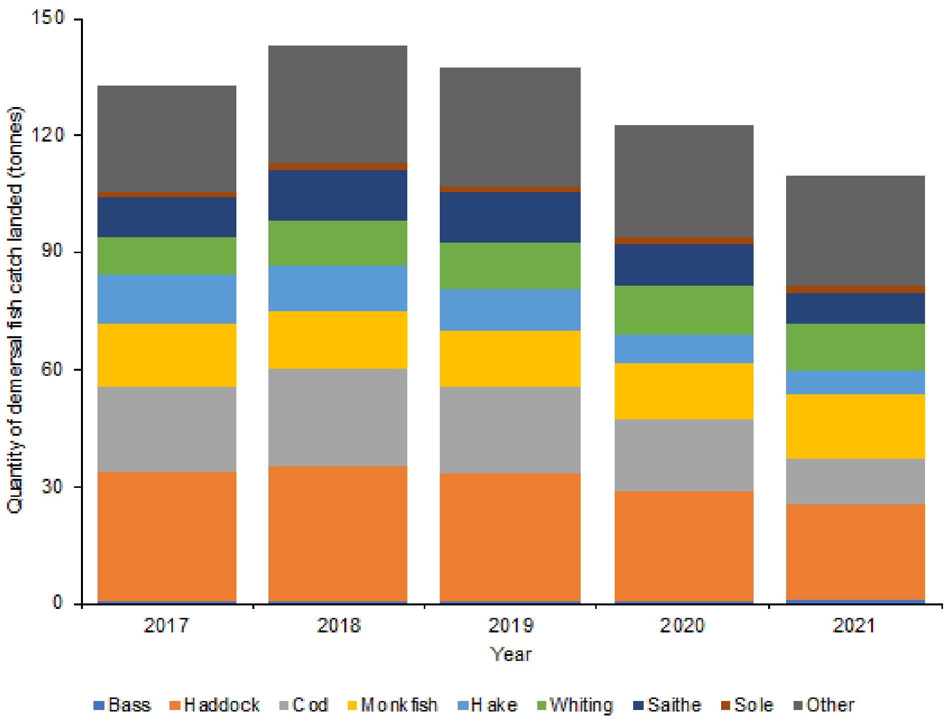
Model outputs include plots of catch-at-age in thousands by gear, a table of simulation results and then a final table summarising the forecast, including the impact in the SSB and the change in advice. The table compares the simulated catch allocations with the forecast scenarios from the ICES advice. There have been some criticisms of the tool, which are being overcome as the tool develops. Some of the criticisms have included (NSAC, 2022):

- The catches allocation tool does not consider catches' seasonality, which is a very marked trait for certain metiers, nor the higher activity constraints imposed on commercial fishing by a monthly and catch limitation. The tool is largely free from the restrictions applied in reality and cannot be used to test measures (such as the percentage of total catch per trip for demersal trawls and seines) other than individual catch limits.

- The tool is very unrealistic in assuming that each vessel exhausts its entire catch limit and consequently greatly overestimates the fishery withdrawals.

4.5 Relative importance of bass fisheries compared to broader fishing opportunities

In 2021, there were 5,783 UK registered fishing vessels, landing 652,000 tonnes of sea fish of value £921 million (MMO, 2021). Vessels under 10 metres made up 79 % of the fleet and while these only contributed 8 % to the fleet's total capacity, these vessels generally fetched a higher price per tonne for their landings, especially for demersal catches (in which bass are included), mainly due to larger vessels freezing their catches and selling in bulk (MMO, 2021). In entirety, bass made only minor contributions to landings and values of demersal fish captured by UK fishing fleets, where between 2017 and 2022, they comprised between 0.30 and 0.55 % of demersal fish catches by landings and 1.4 and 2.4 % by value (Figure 4.7).



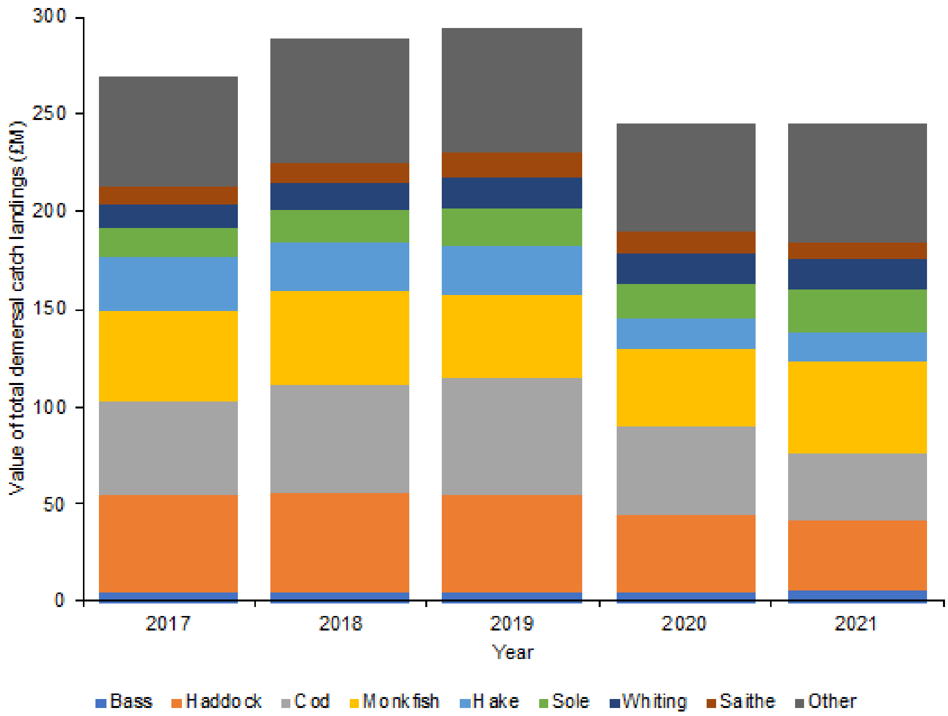


Figure 4.7. Quantity (top) and value (bottom) of demersal fish species landed by UK fishers in UK ports between 2017 and 2021 (MMO, 2021).

Although bass only make a minor contribution to overall UK demersal fish catches, their populations are nevertheless of high value to the UK's large inshore artisanal fleets (ICES, 2021). Bass are a relatively high value species, attracting a price per liveweight tonne which, since 2015, has been similar to other high value fishes such as sole and turbot, and is approximately four times higher than demersal species generally captured in bulk by larger vessels offshore, such as cod and haddock (Figure 4.8). As a result, many small-scale artisanal fisheries have a high seasonal dependency on using methods including line fishing and some forms of netting for bass (Figure 4.9), with landings in 2021 being relatively high between May and December (Figure 4.10).

Indeed, comparison of total landings and bass landings of vessels below and above 10 m from four UK fishing ports emphasise the importance of bass to catches for vessels < 10 m and their relative unimportance to larger vessels (Table 4.6; Watson *et al.,* 2022b).

Table 4.6. Total landings and bass landings from four ports in England according to vessel size (< 10 m, > 10 m), with the majority of fish caught in gill nets or by hook and line (Watson *et al.,* 2022b).

Port name	Total landings (t)		Bass landings (t)		Bass % of total value of catch	
	< 10 m	> 10 m	< 10 m	> 10 m	< 10 m	> 10 m
Burry Port	247	-	129	-	87	-
Plymouth	4,207	47,320	137	44.6	15	0.63
West Mersea	580	68	74	0.4	44	1.66
Weymouth	1,891	6,356	254	0.6	44	0.03

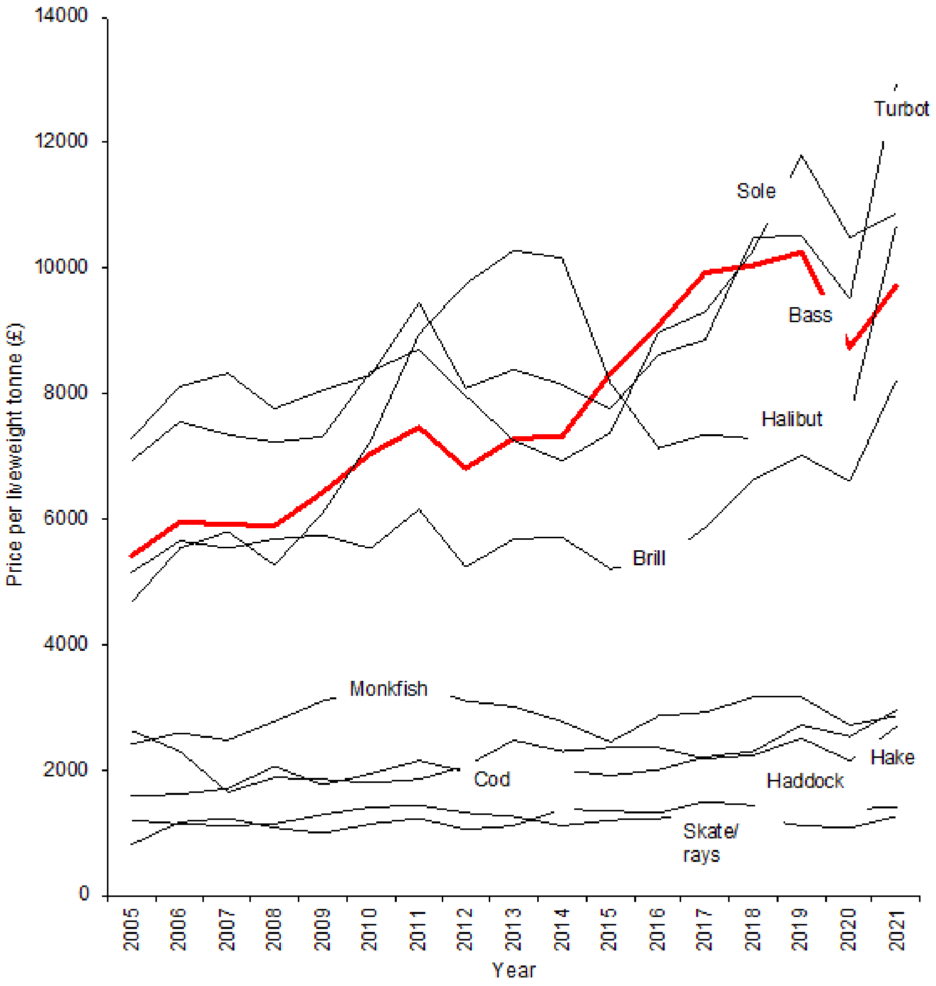


Figure 4.8. Price per liveweight tonne of demersal fishes landed in UK ports between 2005 and 2021 (MMO, 2021).

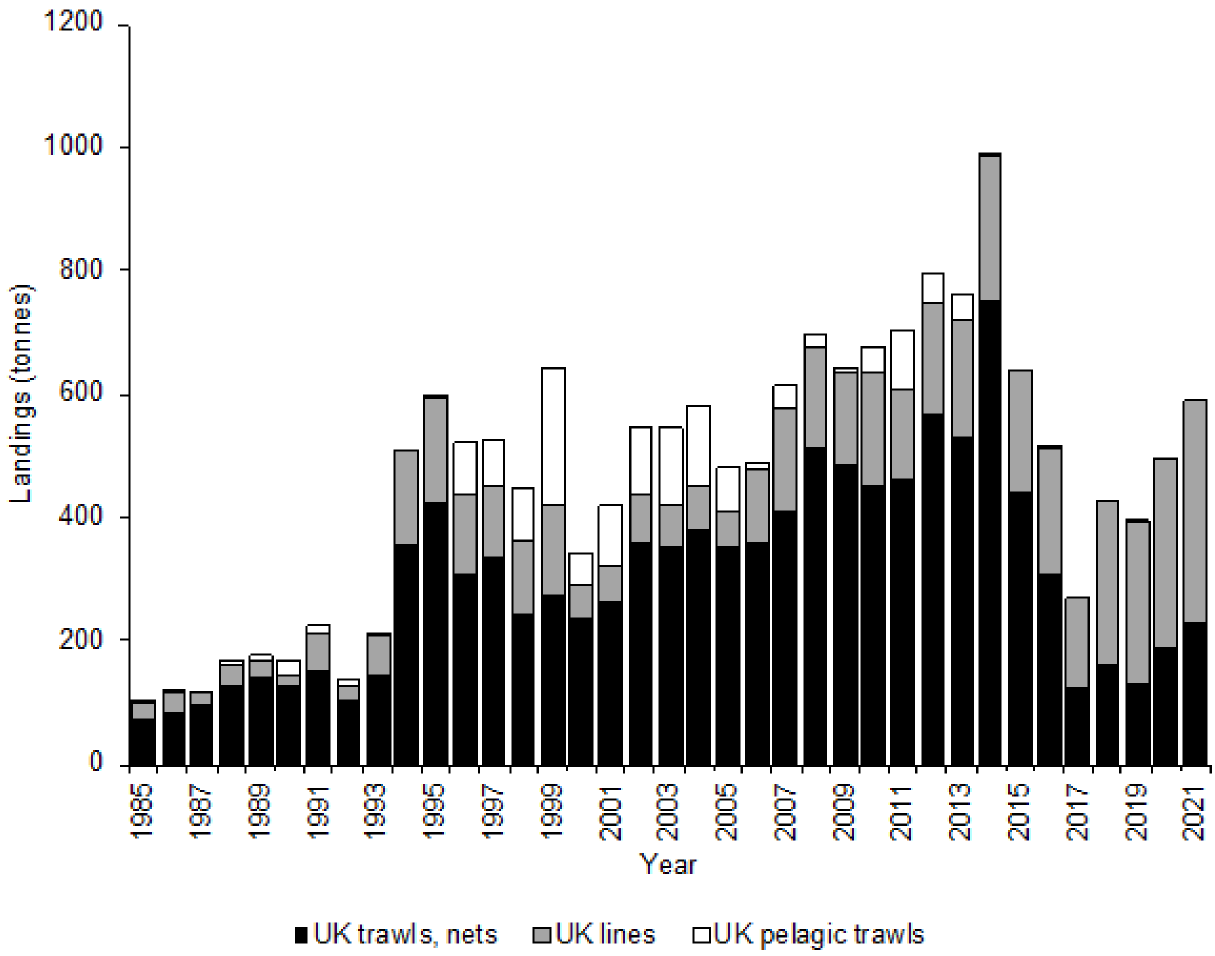


Figure 4.9. Landings of bass by UK commercial bass fishers according to fishing method (ICES, 2021). Note that pelagic trawl catches were affected in winter 2014 by adverse weather, prior to the ban from 2015 (Section 4.1)

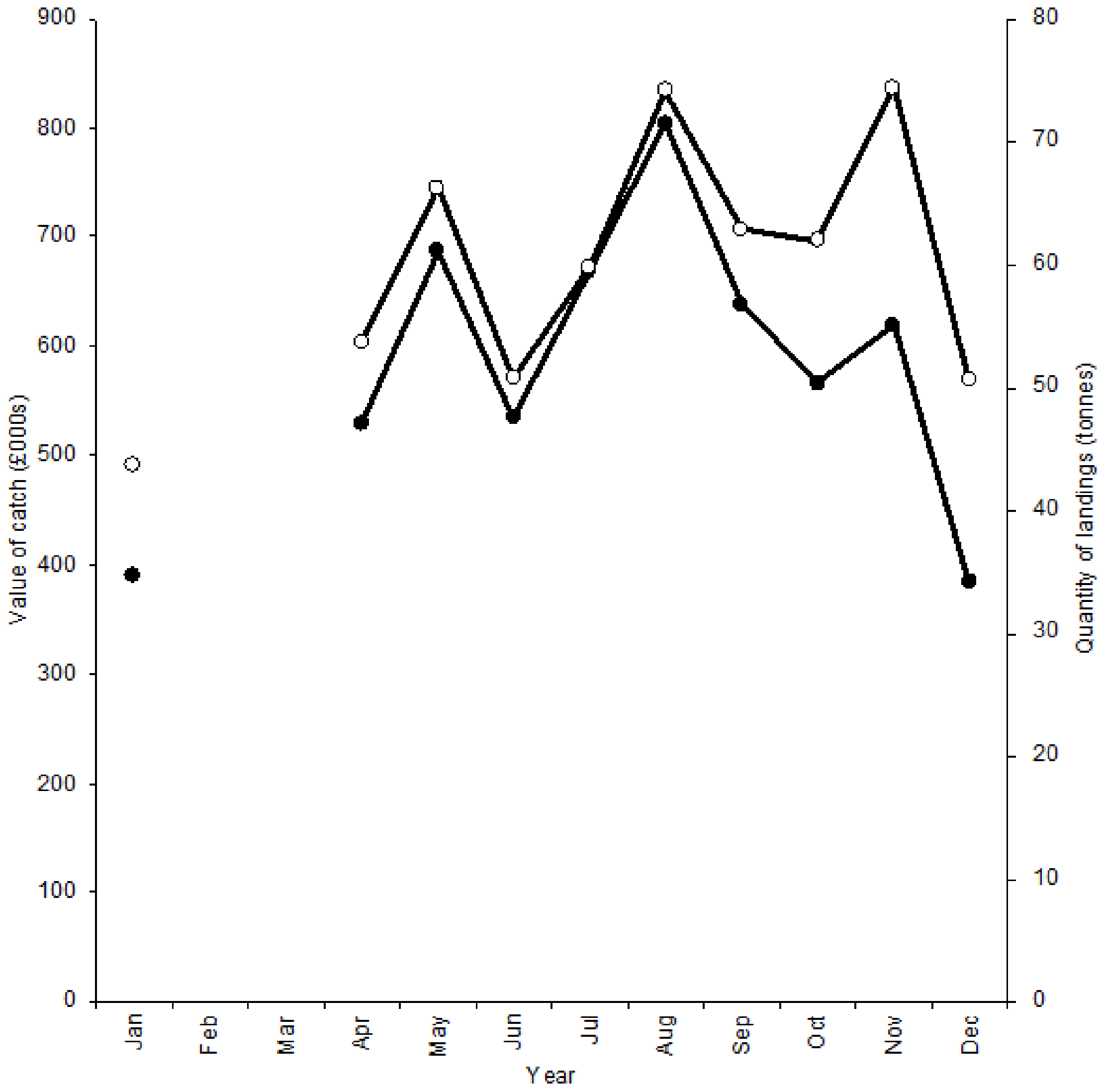


Figure 4.10. Value (filled circle) and quantity (clear circle) of bass landed in UK ports in 2021 by month. Note that no fishing is permitted in February and March.

These small-scale artisanal fisheries developed in the 1990s and 2000s on the back of the strong bass recruitment in the late 1980s and early 1990s (Figure 4.5), with the development of new markets that competed strongly with farmed bass. With bass lacking quota / total allowable catch, increased fishing mortality meant F_{MSY} was exceeded which, coupled with weak recruitment since the early 1990s, resulted in reduced SSB from 2010 (Figure 4.5) and, thus, the new measures implemented in 2015 to prevent stock collapse (Section 4.7).

The importance of bass to inshore artisanal fleets, as well as to recreational fishing, means they contribute substantially to local economies (ICES, 2021; Section 4.6). Moreover, high volume, lower quality catches of offshore spawning bass captured by French pelagic trawlers used to attract prices up to three times lower per kg than for smaller volume sales of higher quality fish from inshore fleets (Drogou *et al.,* 2011). Thus, for relevant UK inshore fleets, bass have remained a highly important target species since the imposition of the new regulations in 2015, despite the species being relatively minor in terms of their overall contribution to UK demersal fish catches (Williams *et al.,* 2018).

4.6 Economic and social impacts of fisheries management measures

4.6.1 Commercial fisheries

It was outlined in Section 4.5 that the commercial fishing sector that exploits bass is relatively small-scale, contributing only minor proportions to UK demersal fish landings and values, but that at a local scale, the species provides inshore fleets (mainly comprising of relatively small vessels) with a seasonal fishery targeting a high value species. Indeed, economic dependency on bass in France, the Netherlands and the UK generally only concerns fleets where vessels are < 18 m (and often < 10 m; Section 4.5) and that mainly use hooks and line as the capture method. In 2016, only Dutch vessels under 10 m using passive gear had an economic dependency on bass of over 50 %, with French vessels under 12 m and that used hook-based gears having economic dependency levels of 34 to 47 % (EUMOFA 2021). In the UK, between 870 and 1004 vessels were engaged in bass fishing between 2016 and 2021. Of UK vessels with > 20 % economic dependence on bass, there was been a decrease in the proportion of larger boats, from 38 % of vessels were > 18 m in 2016 to 7 % in 2021 (when 79% of vessels were < 12m (SeaFish, 2023).

Data on revenues and costs of these small vessel fleets have enabled the following economic performance indicators to be determined: income (income from landings, fishing rights, other income sources and direct subsidies); gross value added (GVA; income (as already defined) minus energy costs, repair costs, and other variable and non-variable costs; and earnings before interest, taxes, depreciation and amortisation (EBITDA; GVA minus wages and salaries of the fishing crew; Scientific, Technical and Economic Committee for Fisheries, 2023). In 2016, most fleet segments that fished for bass in the UK, Netherlands and France had positive GVA and EBITDA, indicating the economic sustainability of fleets that had relatively high economic dependence on bass (EUMOFA 2021. Between 2008 and 2016, the economic performance (according to these performance indicators) of French vessels < 10 m using hook-based gears increased, but decreased for French and Dutch vessels < 10 m that used passive gears (EUMOFA, 2021). For fleet segments less dependent on bass, economic performance varied considerably in the same period, where the sources of variation included the gears used and country where the fleet was based (EUMOFA, 2021). There was, however, a general pattern that the fleets which experienced the highest income increase were those that used hooks as their fishing method (mean income increase between 2008 and 2016: 47 %), as these fish attract higher prices due to their superior quality versus trawled fish (EUMOFA, 2021).

In the UK, the economic metrics of fishing income, GVA, operating profit, net profit and GVA to fishing income margin were all positive in fishing fleets associated with bass between 2016 and 2021. However, all metrics showed patterns of decline in this period, with GVA – a proxy value of sector contribution to gross domestic product and a measure of value created for society – reducing by 68 % in the period, while the GVA to fishing income margin (indicating economic efficiency and profitability) falling from 46 % to 35 % (SeaFish, 2023). In the same period, the number of people employed in fishing in these vessels (as full-time equivalents) fell to its lowest value in 2020, a reduction of 73 % from 2016 (SeaFish, 2023).

The first point of sale data of bass captured from the Northern stock in 2018 was 5.3M € in the UK and 3.7M € in France, corresponding to 1 %and 2 % respectively of total first sale values (EUMOFA 2021; Section 4.5). In recent years, bass first point of sale values have increased in UK fish auctions (cf. Section 4.5), where increased prices (Fig. 4.11) have compensated for lower catch volumes (e.g. 56 % price increase in 2018). Conversely, in French auctions, first sale values have decreased strongly in recent years, albeit with a large increase in 2018 (EUMOFA 2021).

The French bass supply chain including fish auctions, wholesalers and then the retailer/fishmonger and foodservice sectors (EUMOFA 2021). While bass are marketed as whole and fresh fish, there is strong market segmentation according to: captured versus farmed fish (e.g. prices of wild bass can exceed 30 €/ kg, farmed bass prices are generally below 10 €/ kg); size category (larger fish attract considerably higher prices); and fishing method (trawled bass are cheapest, hook and line captured bass are most expensive (EUMOFA 2021).

These economic figures, coupled with those from Section 4.5, emphasise that wild caught bass remain a high-end product, with a market that focuses mainly on fishmongers and restaurants (EUMOFA 2021). However, it remains unclear as to how the management measures implemented in 2015 have directly impacted the economic performance of these inshore fisheries (given fish catches were declining generally and cannot always be offset by increased prices at the first point of sale). While information has been discussed here in relation to income, GVA and EBITDA, there remains considerable knowledge gaps in aspects such as the total economic value of these wild fisheries and the impact of these beyond just the first sale value, and more social aspects, such as the number of jobs these fisheries support onshore (ICES 2021; Section 5). Some of this uncertainty is through the difficulty of decoupling the contributions of bass from other fishes captured by these fleets, as their economic dependency on bass can be relatively low (< 30 %; EUMOFA 2021). Understanding the wider socio-economic importance of wild bass fisheries is thus important in the context of designing and implementing future management measures, including within the UK FMP.

An aspect that has been largely overlooked so far is the characterisation and valuation of cultural ecosystem services (CES) gained from bass fisheries, perhaps because CES are, generally, difficult to identify in marine ecosystems. Nevertheless, culture and marine fisheries are strongly linked (Fletcher *et al*., 2014), with declining and collapsed fisheries weakening the social cohesion of coastal communities (Gowdy et al., 2010). As fisher cultures have not always able to return to their former state following fishery collapse, then fishery changes drive irreversible cultural shifts (Turner et al. 2003). With bass being a species exploited by inshore fishers, usually in relatively small vessels, then if these fisheries do disappear due to either declining catches or catch allocations no longer providing a profitable fishery, then the sense of identify provided by the links of culture and the sea could be weakened, especially if it breaks a previously strong familial link to bass fishing (Fletcher et al. 2014). The same principles also apply to the recreational fishery (Section 4.6.2). Indeed, the erosion of social links of coastal communities to inshore marine resources could occur if bass catch allocations misjudge the balance between the commercial and recreational sector, and if the bass FMP fails to support a sustainable stock. However, no work has been completed on the cultural values of bass fisheries to date and so these aspects remain speculative at present.

4.6.2 Recreational fisheries

Recreational sea fisheries contribute relatively high levels of spend into national economies (Armstrong *et al.,* 2013; Roberts *et al.,* 2017; Hyder *et al.,* 2018a). In Europe, the total economic impact of marine recreational fisheries has been estimated at approximately 10.5B € , with close to 100,000 jobs being supported (Hyder *et al.,* 2017; 2018a). In the UK, there are around 772000 adult sea angling participants who create a total economic impact of £1.6B to 1.9B per annum (Hyder et al., 2020, 2021). Moreover, there are benefits to society resulting from the individual activities of sea anglers, including health and well-being, environmental improvement, and volunteering.

In European recreational sea angling and its dependent businesses, bass is considered as an important and valuable species, with an estimated 2 million anglers at least occasionally targeting the species, with the European Anglers Alliance providing an estimate of the socio-economic value of recreational bass angling as 100 € per bass angler per year and thus an annual total of 200M € (European Anglers Alliance 2023). However, these figures are highly approximate and might not capture bass angling expenditure accurately. Prior to the implementation of bag limits, bass anglers in France captured 4 million fish per year of which approximately half were kept, with at least 20 % of French recreational anglers targeting the species who directly spent 100M € per year (IFREMER, 2011). In Ireland, the economic contribution of bass angling to the economy has been estimated as 52M €, where total recreational angling expenditure in Ireland is 169M € (National Strategy for Angling Development, 2015). In the Netherlands, the socio-economic value of recreational bass angling has been estimated as 16M€ per year (Armstrong et al., 2014).

It is, however, inherently difficult to assess socio-economic measures of species-specific recreational fisheries (e.g. willingness to pay (WTP), welfare impact), as decoupling figures of total economic values of angling to the species level is difficult. This difficulty is through issues of partitioning spending between species (given most gear can be used for multiple species) and such total economic impact studies not including individual behaviour changes. The latter point is important as a complete cessation of sea angling would likely lead to a partial loss of the total economic impact generated as most anglers would redistribute their spend to other recreational activities, whereas a loss of access to sea bass fisheries might just see anglers switch to other target species available using similar gear (Armstrong et al., 2013). However, some studies have been completed which do provide estimates of such socio-economic metrics. For example, studies estimated the management impacts on bass recreational fisheries suggested that an increase of 50 % from current bass catch levels of anglers in southwest England would result in a welfare increase of £8.46 for an average trip (Lawrence, 2005).

Sea angler preferences for changes in sea bass management measures - as marginal WTP - suggested that for catching one bass per session, anglers were willing to pay £11 to £31, with higher WTP for keeping the fish (Andrews et al., 2021). However, catching at least two bass only gave a slight increase in WTP, indicating that the first fish was most valuable and that harvesting a fish for consumption can be an important motivator for sea angling participation (Andrews et al., 2021). Assessments of the welfare impact on society of changing sea bass management suggested that the lowest impact was from a no-take fishery and highest impact from a fishery with the lowest restriction levels, with the difference between these levels of £22M (Cevenini et al., 2023). In combination, these studies indicate higher economic values of bass recreational fisheries can be gained with more light touch regulation and where at least one fish can be harvested per angling session.

Where comparisons are made between the relative benefits gained from bass recreational versus commercial fisheries for sea bass suggested the final economic output was higher in the recreational sector, although some caution is warranted through some of the assumptions used in economic impact assessment perhaps considered as unrealistic (MRAG, 2014). A system dynamics model framework that captured biological and economic elements of the European bass fishery, which incorporated a catch limit reflecting sustainable fishing with adjustable partition between recreational and commercial sectors, and low, medium, or high recruitment, indicated that recruitment had a large impact on the fish population dynamics and the viability of the sectors (Tidbury et al., 2021). This model output emphasised the importance for viable bass fisheries of strong recruitment and thus suggested that management efforts should seek to maximise recruitment during favourable environmental conditions.

4.7 Methods of allocating fishing opportunities for UK bass fisheries

4.7.1 Principles of allocating access to fishery resources

Resource allocation is a crucial and challenging component of common pool resource (CPR) governance, which aims to avoid the ‘tragedy of the commons’ whereby CPRs are managed sustainably and without compromising the resource base (Seto *et al*., 2021). In marine systems, the basis of this governance has moved towards ecosystem based management approaches, where the conservation and sustainable use of resources are promoted, while ensuring access to the resource is allocated in equitable way (Tidbury *et al*., 2021). Indeed, amendments to the Common Fisheries Policy (CFP) of the European Union in 2013 embedded an ecosystems approach (Article 17), in which access to specific fisheries should be based on transparent and objective criteria, including biological, economic and environmental criteria (EU, 2013).

There is considerably less knowledge on the how resource allocations should be then shared among users in a fair and equitable way. Co-management approaches, where both government and stake-holders are involved in management decisions, their implementation and enforcement, are helpful in achieving more equitable and sustainable solutions (Plummer and Fitzgibbon, 2004). However, moves to ecosystem based management means catch and/ or effort allocations also require consideration of the biological, social and economic elements of fishery exploitation and, where appropriate, in both commercial and recreational sectors (Tidbury *et al*., 2021). This is particularly true in the case of bass, where the relatively high value of its recreational fishery is recognised through their data being used within stock assessment exercises (Section 4.4), given removals are estimated as approximately 27% of total removals (Section 4.2).

4.7.2 Implicit and explicit catch allocations

Fishing allocation decisions can be either implicit, where management drives the catch share allocated to each sector, or explicit, where a catch share is set for the commercial and recreational fisheries before management is implemented to achieve it (Bailey et al. 2013). Explicit allocations are apparent in some fisheries, such as the Gulf of Mexico red snapper fishery where vessels received individual catch allocations that they then managed across the year (Abbot & Willard, 2017). However, catch allocations for species in European fisheries have generally been implicit, including for bass.

4.7.3 Allocating fishing within the European Union, including UK pre-withdrawal

The setting of most fishing limits in the EU (including the UK as a Member State (MS)) was made through negotiations of the Council of Ministers, with the subsequent allocation of these fishing opportunities largely being the responsibility of each MS. In these allocations, Article 17 of the CFP states:

"When allocating the fishing opportunities available to them, as referred to in Article 16, Member States shall use transparent and objective criteria including those of an environmental, social and economic nature. The criteria to be used may include, inter alia, the impact of fishing on the environment, the history of compliance, the contribution to the local economy and historic catch levels. Within the fishing opportunities allocated to them, Member States shall endeavour to provide incentives to fishing vessels deploying selective fishing gear or using fishing techniques with reduced environmental impact, such as reduced energy consumption or habitat damage".

Thus, fishing fleets that deliver the best value to society ought to have had preferential access to fishing opportunities. These criteria include a mixture of economic, environmental and social indicators, which focus on selectivity, resource dependency and wider environmental impact (Williams *et al.,* 2018).

4.7.4 Fisheries management in the UK post-EU withdrawal

Following EU withdrawal, the UK is now an independent coastal state with rights and duties under the United Nations Convention on the Law of the Sea to control and manage resources in its waters. Withdrawal also means the CFP no longer applies, so providing the opportunity for reforming management of marine fisheries, including the ability to negotiate with the EU and other coastal states for accessing fishing opportunities. The Fisheries Act 2020 provides the legal framework for quota distribution and the development of Fisheries Management Plans (FMP) (including for bass, which is a non-quota species), where these plans must:

(i) Identify the stock, type of fishing and geographical area to which it relates,

(ii) Specify an indicator(s) to be used for monitoring the effectiveness of the plan,

(iii) Specify whether the available scientific evidence is sufficient to enable the relevant authority or authorities to make an assessment of the stock's MSY, and

(iv) if it is, it must specify policies of the relevant authority or authorities for restoring the stock to, or maintaining it at, sustainable levels or for contributing to its restoration to, or maintenance at, sustainable levels.

FMPs also must consider the available evidence concerning social, economic or environmental elements of sustainability, and how these can be measured or considered in the context of fish and fishery sustainability in UK sovereign waters, where many fisheries exploit stocks that are international in their distribution (such as bass). Nevertheless, the post-UK withdrawal legislation means that fishing out of UK waters on board British flagged ships needs to be sustainable, complying with both UK legislation and the requirements by the nation that granted the fishing licences (van Balsfoort *et al*., 2022). This implies that there is a need to measure sustainability in the economic, societal and environmental dimensions of fisheries and working through cooperative approaches to guarantee the future of the sector. It has been suggested that this could be achieved using the Fish Performance Indicators (FPIs) of Anderson *et al*. (2015) (*cf*. van Balsfoort *et al*., 2015). These FPIs, already used by the World Bank in relation to different communities both in developed and developing countries, assess the performance of individual fisheries and in relation to stock health, and economic and social criteria. However, their use of 68 individual outcome metrics, and outcomes that are explained with 54 metrics of inputs, management approaches and enabling conditions, also suggests some complexity in the approach (Anderson *et al*., 2015). Moreover, they are based on qualitative indicators based on expert opinion for use in data-poor fisheries at present so would need converting to quantitative metrics for use in UK fisheries that, relatively speaking, are data rich (van Balsfoort *et al*., 2015).

4.7.5 Bass fishery allocations in UK Fishery Management Plans

The UK withdrawal from the European Union and the development and implementation of FMPs provides opportunities for future allocations to better reflect the biological, social, economic and environmental considerations that are integral to the management of inshore bass stocks. This management needs to consider both commercial and recreational bass fisheries and that while management is being implemented at a UK level, it is dealing with a stock whose range is not restricted to national boundaries. Moreover, there remains major knowledge gaps in how to reconcile the biological, social, economic and environmental considerations. While the ecosystems/ natural capital approaches outlined earlier are embedded in many management approaches and allocation methods at global levels, these can also overlook the cultural ecosystems services provided by both commercial and recreational fisheries. This indicates that, ultimately, how fishing allocations are made in future is, arguably, a societal decision regarding what society values in a fish stock and the fishery it supports. Indeed, FMPs do provide the opportunity for society to feed into their development, with stakeholder input embedded in the process.

The system dynamics model framework of Tidbury et al. (2021) provided important insights into the various trade-offs involved in these bass catch allocations between the sectors and under different recruitment scenarios (low, medium, high). The model represented a simplified and stylised bass fishery (commercial and recreational) and by implementing a sustainable catch limit, it evaluated the relative biological and economic impacts of different allocation scenarios. Although allocations that enable both the commercial and recreational sectors to be viable in conjunction with a sustainable bass population, model predictions revealed that the scenario where this occurred was the high recruitment scenario (Tidbury *et al*., 2021). Under conditions of low recruitment, the bass population was predicted to collapse, along with their fisheries and irrespective of allocation. Under constant medium recruitment and no management, cyclic commercial fishing activity was predicted, where the commercial vessels operate close to their profit thresholds and so reduced fishing pressure when their profits decrease, resulting in an increased bass population size, while 75 % allocation to the commercial sector predicted cyclic dynamics once more (Tidbury *et al*., 2021). At commercial allocations < 50 %, the sector was predicted as no longer profitable, reducing fishing activity but increasing bass population size. The recreational fishery was predicted to collapse under scenarios of both medium recruitment/ no management and medium recruitment/ >50 % commercial allocation. Allocations >50 % to the recreational sector resulted in a prediction of increased bass population size and a viable associated angling industry (Tidbury *et al*., 2021).

These predictions by the model of Tidbury et al. (2021) demonstrates that the current implicit catch allocation following ICES advice will not necessarily result in viable commercial and recreational fisheries according to biological, economic, social and environmental criteria. However, the predictions do emphasise the importance of successful recruitment of bass populations to their fisheries, where the drivers of recruitment have already been demonstrated as largely environmentally driven.

5. GAP ANALYSIS

Gap analysis makes a comparison of the actual/current level of evidence/knowledge versus the potential/desired level, revealing the gaps in evidence that can be improved upon to move knowledge towards the desired state (Dimarchopoulou *et al.,* 2017). For Northern stock bass, the evidence gaps stem from the difference between current and desired knowledge, where the desired level enables FMPs to be developed based on robust and rigorous information, with minimal uncertainty and high knowledge levels across all relevant population processes and life-stages, and fishery assessment processes.

Here, evidence gaps were identified following completion of the review syntheses. While some gap analyses enable quantification of the extent of the evidence/knowledge gap through numerical scoring, the approach used here was more qualitative and based on the views of the authors. Aspects of bass biology, ecology and fisheries were considered according to the extent of (i) current evidence, apparent from the review syntheses; and (ii) uncertainty within this knowledge (e.g. resulting from variability and/or a lack of supporting evidence in the literature, but necessarily the age of that information, accepting that older studies might be less relevant due to, for example, changing environmental conditions and higher exploitation). The results are represented on a plot of evidence versus uncertainty (Figure 5.1).

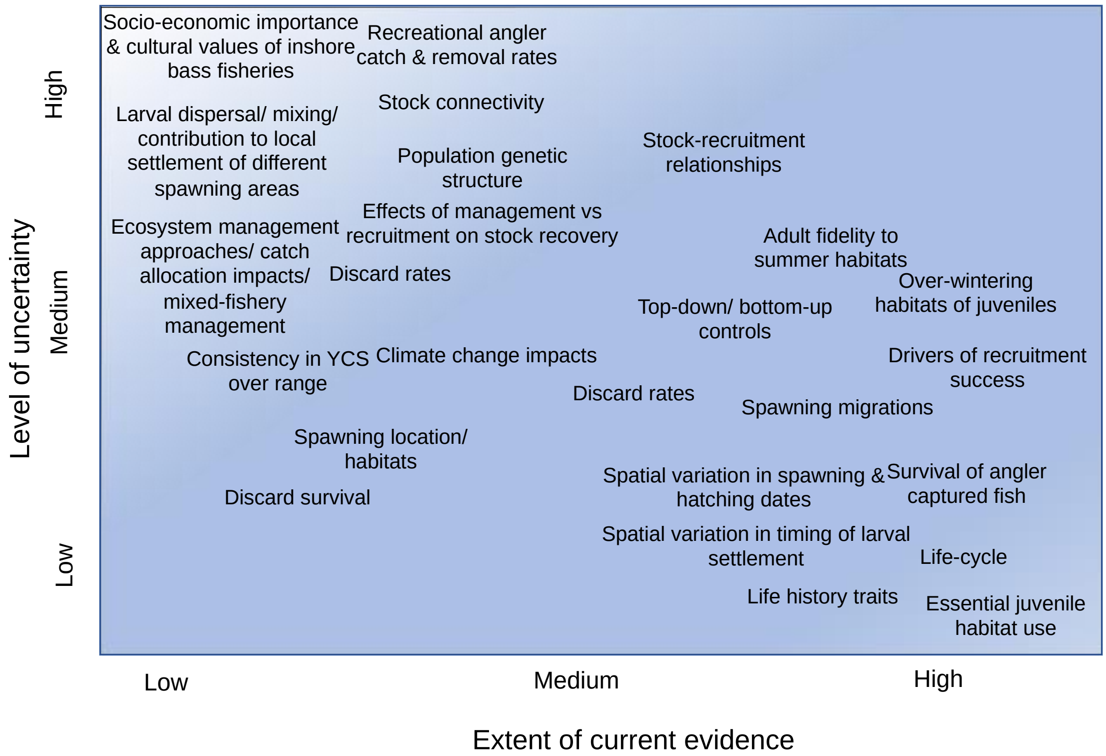


Figure 5.1. Relationship of the extent of current evidence versus the level of uncertainty in that evidence for aspects of the northern bass stock biology, ecology and fisheries, as assessed by the authorship team; the most substantial knowledge gaps are in the top left of the plot, those of least concern in the bottom right.

Figure 5.1 indicates that there are areas of evidence on bass biology, ecology and management where there is a considerable volume of information of low uncertainty, such as essential juvenile habitat use (e.g. estuaries) and life history traits (relatively slow growing, long-lived, maturing at age 3 to 6 years, high fecundity) (Sections 3.1, 3.2). However, there are some areas where current evidence is both limited and uncertain, especially:

- The socio-economic importance of inshore artisanal bass fisheries, especially after the first point of sale and their overall contribution to local, regional and national economies (Section 4.6).
- Cultural values of commercial and recreational bass fisheries, and the extent to which social links between people and the sea will be weakened by the decline or loss of bass fisheries.
- The outcomes of different management approaches (e.g. ecosystem versus mixed species) and catch allocations (within commercial sector, and between the commercial and recreational sector) and whether their interaction with long-term recruitment will provide sustainable fish stocks and fisheries (according to FMP criteria).
- The extent of recreational angler catches and removal rates, and how removal levels compare with the commercial harvest (Section 4.3).
- Extent of philopatry in adults to specific spawning areas and the processes involved in this philopatry (e.g. homing, stock memory) (Section 3.8).
- Larval dispersal dynamics and mixing events, especially in the mixing zone off northwest France, and the extent to which post-larval settlement into specific nursery areas is driven by spawnings in different spatial areas (Sections 3.3 to 3.6).
- The extent of connectivity in the adult stock, especially at spawning, and how this connectivity and larval mixing influence population genetic structure (Sections 3.4 to 3.6).
- The role of recruitment and strong year class strengths on SSB recovery versus management actions (e.g. increased MCRS) (Sections 4.3 to 4.7).
- Data on discard rates remains low and uncertain due to data being collected only through observer schemes on vessels not specifically targeting bass and covering a low proportion of all UK fishing trips.
- How IBMs can better complement catch allocations through simulations that predict the outcome of different environmental and management scenarios (Sections 4.3, 4.4).
- The impact of climate change on northern bass stocks, including on their growth, body sizes and condition, distribution, abundance and capture vulnerability (Section 3.10).

It is these evidence gaps that are suggested as being the highest priority to overcome in order to produce a robust FMP. Other gaps where consideration is needed for further work include how the stock units used in ICES assessments relate to the genetic structure of the Atlantic bass population

(Sections 3.6, 4.1), where evidence is increasingly suggesting a lack of structuring due to some mixing of fish, most likely at spawning time rather than at larval dispersal, but with further work needed here.

6. SUMMARY AND RECOMMENDATIONS

6.1.1 Summary

As a species, bass has a relatively complex lifecycle encompassing estuarine, inshore and offshore habitats, some fidelity to inshore areas and, potentially, philopatry to spawning areas. While the offshore bass fishery targeting spawning migrants is no longer permitted (since 2015), inshore bass fisheries remain important locally. Although comprising very minor components of demersal fish landings and values overall, they are an important target species for vessels < 10 m, where fish captured mainly between April and November on hooks/lines and nets comprise high quality fish that attract relatively high prices at the first point of sale.

Bass is also an important target species for many recreational anglers in coastal areas. Catch and release rates were already relatively high prior to 2015 (e.g. 75 %, Armstrong *et al*., 2013; 77 %, Ferter *et al.,* 2013), with a high proportion of these released fish expected to survive (95 %; Lewin *et al*., 2018), but with recreational angling now subject to other measures, including bag limits. There remains some conjecture in the proportion of bass removed by recreational angling versus commercial fishing. Moreover, there remains high uncertainty in the socio-economic values of these fisheries, with little evidence available regarding the socioeconomic value of the commercial sector beyond the first point of sale. While there is comparatively more evidence on the value of recreational fisheries, these values are mainly at a multi-species level, with some difficulty in decoupling values to stock levels. Thus, there is a considerable evidence gap in the socioeconomic values of all these bass fisheries and how these have been impacted by the post-2015 management measures.

The substantial decreases in SSB between 2010 and 2015 resulted from the interaction of a series of weak year classes and increasing fishing mortality following higher fishing effort and market development in the 1990s when the strong year classes of 1989 and the early 1990s were being exploited. The net result of the decline to 2015 was the implementation of catch limits, technical measures and seasonal closures (but note seasonal closures currently only cover part of the spawning season in the Northern bass stock). These measures have yet to see the restoration of SSB to former levels, as recruitment levels remain relatively low. Indeed, the relatively weak relationship between SSB and recruitment emphasises the importance of environmental conditions on recruitment and, ultimately SSB. Thus, the measures imposed in 2015, and stock management more generally, is aiming to maintain SSB at levels that when favourable environmental conditions for recruitment do manifest, the potentially high strength of the year class can be realised and result in marked increases in SSB in future years.

The management of Atlantic bass stocks currently considers four stock units, of which two are assessed annually by ICES, with the production of catch advice (the Northern and Biscay stock units). Although these stock units enable spatial management, their biological basis is increasingly questionable, with larval mixing from discrete spawning areas and/or mixing of a small proportion of adult spawners from across their range likely to be driving panmixia in the Atlantic area, with little or no structuring. However, the extent of this mixing and its influence on genetic structure remains uncertain and requires further work, which could include incorporating other methods to help this, such as otolith microchemistry and stable isotope analysis.

Irrespective of whether the Atlantic stock is managed in discrete stock units or as a genetically homogenous stock in future, the results of simulations completed in IBMs show high promise in predicting the response of bass stocks to the interaction of environmental variability and different scenarios of fishing effort. Further efforts to develop spatial stock assessments would be highly insightful in the context of both environmental and fisheries management, and with further development of models and the bass allocation tool is warranted. These tools also have the power to predict how climate change will influence bass populations, both in terms of their biology (e.g. growth rates) and distribution, through incorporating climate change projections. Indeed, while knowledge on the likely consequences of climate change for bass populations has received attention in regard to their biology (e.g. minimal consequences from ocean acidification, potentially high consequences from extreme temperatures), information on their distribution changes remains relatively limited, including how these will influence stock abundances and fish catches in more northern areas.

6.1.2 Recommendations

The principal recommendations arising from this evidence review are two-fold:

1. At the UK level, there is arguably a reasonable evidence base provided in this review on bass juvenile life-stages, recruitment processes, movements, spawning migrations and the knowledge gained from stock assessment exercises for developing an initial bass FMP This evidence base demonstrates, for example, that the spawning period of the Northern bass stock extends to at least May, but the closed fishing periods to protect spawning bass concludes at the end of March. It is also acknowledged that there is considerable scope for this knowledge base to be developed further, especially in ensuring they are complemented with contemporary studies, given some of the seminal work is now over 30 years old.
2. As at the UK level, aspects of FMP development will be constrained due to evidence that is both limited in extent and its certainty (Section 5), there is a pressing need to for these limitations to be resolved, where some of these evidence gaps only able to solved at a stock level involving international cooperation and negotiation (e.g. extent of removals of northern stock bass by recreational anglers).

Of the knowledge gaps that are recommended for prioritisation, it is considered that the following areas are seriously deficient in knowledge to the point where this deficiency will inhibit FMP development:

1. The socio-economic and cultural importance of inshore bass fisheries (including recreational) and how this is affected by management changes.
2. How to allocate bass catches between sectors in a fair and equitable manner that considers biological, social, economic and environmental considerations (and, ideally, cultural also), and accounts for the spawning period of the Northern bass stock does not conclude until at least May.
3. Actual recreational angler removal rates and their role in stock decline (relative to commercial landings).

4. Role of larval mixing and adult spawning migrations in driving population structure/panmixia (and thus the applicability of current stock units).
5. Climate change impacts on bass distribution, abundance and predicted fish catches in future.

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APPENDIX 1 – RESULTS OF SYSTEMATIC REVIEW

The following appendices are provided as separate Excel files accompanying this report.

A1.1. 'Search_1_Stock_Structure'

A1.2. 'Search_2_Life_History_Traits'

A1.3. 'Search_3_Pelagic_Drift'

A1.4. 'Search_4_Migration_Movements'

A1.5. 'Search_5_Abundance_Distribution_Life_Stage'

A1.6. 'Search_6_Spawning_Variation'

A1.7. 'Search_7_Habitat_Use'

A1.8. 'Search_8_Ecological_Interactions'

A1.9. 'Search_9_Year_Class_Strength'

A1.10. 'Search_10_Climate_Change'

APPENDIX 2 – RESEARCH PROJECT OUTPUTS

We acknowledge that the following sources of information exist on bass stocks and/or fisheries, including recreational fisheries, and have been considered as part of the systematic review process. However, they were not included within the report as they fell outside of the scope of the project. Please note that this is not an exhaustive list and it is considered likely that other data sources are available that could potentially complement the evidence base presented here.

Association of Inshore Fisheries and Conservation Authorities (IFCA)

http://www.association-ifca.org.uk

For example, Southern IFCA:

https://www.southern-ifca.gov.uk/district-net-fisheries

https://secure.toolkitfiles.co.uk/clients/25364/sitedata/files/Consultation_Documents/NFB-Literature-Review.pdf

https://www.southern-ifca.gov.uk/ongoing-reviews

PISCES Conservation Ltd

https://consult.pisces-conservation.com/index.html

https://consult.pisces-conservation.com/2-hink2001.html

Bangor University

http://sustainable-fisheries-wales.bangor.ac.uk/sea-bass.php.en

http://sustainable-fisheries-wales.bangor.ac.uk/documents/Bass-and-ray-ecology-in-Liverpool-Bay_FINAL.pdf

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University of Plymouth

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https://pearl.plymouth.ac.uk/handle/10026.1/16898

Bass Anglers' Sportfishing Society (BASS)

https://www.ukbass.com

https://www.ukbass.com/science-group-2/

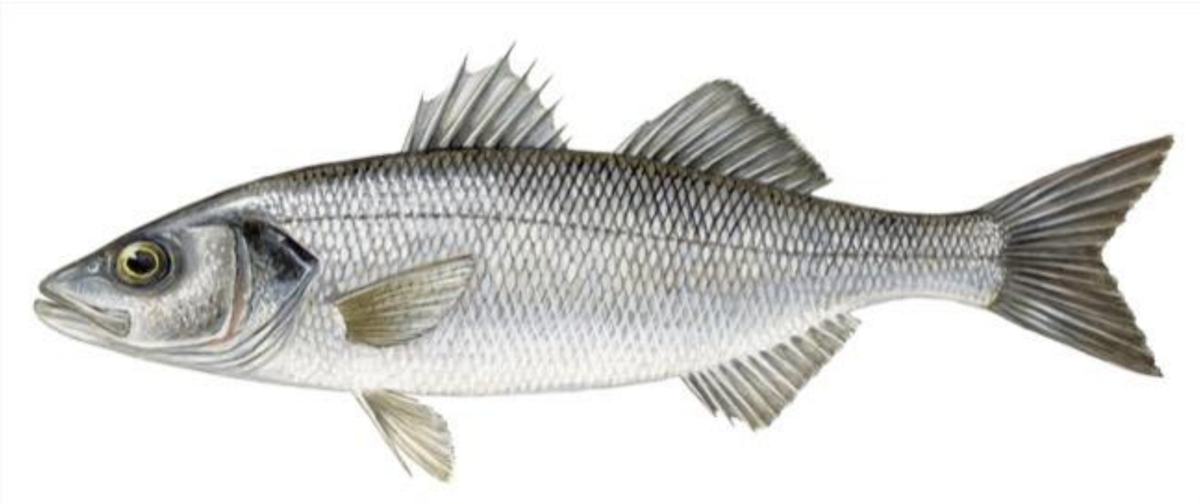
We particularly thank Steve Pitts and Robin Bradley for their access to BASS archives; especially the grey literature (NB. BASS data archives generally fell outside of the scope of the project and were not, therefore, used in the compilation of the evidence base presented here (which was based on systematic review)).

Proposed Fisheries Management Plan for Seabass in English and Welsh Waters

Annex 4: Record of stakeholder engagement

Date: July 2023

Version: Public consultation



Contents

Overview

Stakeholder engagement and co-design for the Bass Fisheries Management Plan (FMP) was facilitated by Policy Lab; a multidisciplinary team of policy makers, designers, and researchers based at the Department for Education. Policy Lab took a collaborative approach for co-design, aiming to build trust among stakeholders and ensure balanced representation of the different sectors within the bass stakeholder landscape.

Policy Lab's project ran from March 2022 to January 2023, and involved over 1400 stakeholders across England and Wales feeding their views into the process (51% commercial vs 49% recreational). The major stakeholder groups consulted consisted of:

- Commercial fishers using a variety of different metiers;
- Recreational fishers using a variety of different metiers;
- Regulators (MMO, IFCAs, Welsh Government enforcement teams);
- Scientists (Cefas, Welsh Government scientists, independent academics);
- Government ALBs and SNCBs (Environment Agency, Natural England, JNCC, Natural Resources Wales, Seafish);
- Representatives of the wider bass supply chain (buyers and sellers for example fish markets, restaurants; charter boat operators; tackle shop owners);
- Environmental groups and NGOs; and
- Policymakers (Defra, Welsh Government)

Methodology

A mixed-method approach was used, consisting of five different stages to ensure all stakeholders were provided with an opportunity to engage. These stages included:

- Evidence discovery and Expert Interviews (March - May 2022). Policy Lab conduced initial interviews with 13 experts from the recreational, commercial, government, and regulatory sectors to better understand the wider bass landscape, challenges faced in the bass fishery and the different sectoral needs and priorities. This helped to inform methods and locations for the subsequent lived experience research phase.
- Lived Experience Research (June - August 2022). This phase of engagement aimed to observe and interact with participants in their real-life environment, and involved engaging with 90 stakeholders across seven locations in England and Wales (Barrow-in-Furness, Seaton-Carew, Pembrokeshire, Stoke Gifford, Newlyn and Hayle, Brighton and Shoreham and West Mersea).

A combination of pop-up sessions and in-depth social research (spending time with participants to observe a 'day in their life') was used.

- Collective Intelligence Debate (August 2022). Policy Lab facilitated a week-long nationwide online 'debate' with 276 participants. This consisted of 137 recreational and 110 commercial representatives, as well as buyers and sellers of bass, scientists, and other representative bodies. The debate aimed to build on insights from the lived experience research.
- Co-Design (September-November 2022). Policy Lab hosted nine co-design workshops in total, with five in-person events (Milford Haven, Plymouth, Lowestoft) and four online workshops. 72 stakeholders attended these events who were chosen randomly using a computerised process to select individuals from a diverse and balanced range of bass stakeholders. The workshops involved practical scenario and idea testing to determine priorities and solutions for the FMP to consider. Policy Lab also conducted an online survey based on the same scenarios presented in the co-design workshops. 477 responses were received, with participants comprising of 52% commercial fishers, 43% recreational fishers and 5% others.
- Co-Refine (November-December 2022). Policy Lab ran an internal co-refine workshop with Defra, Cefas and other relevant arms-length bodies to discuss recommendations from the co-design process, identify knowledge gaps and consider which solutions over the short and medium-long term. Following this, Policy Lab conducted an online survey to sense-check recommendations with wider stakeholders and ask for final comments. The co-refine survey received 449 responses.

As part of the FMP development process, Policy Lab, Defra and Welsh Government also provided regular updates to the wider stakeholder community on FMP progress via existing fora such as the Defra/MMO Regional Fisheries Groups (RFGs), Finfish Industry Advisory Group (FIAG), UK Association of Fish Producer Organisations (UKAFPO) and Recreational Sea Fishing Forum (RSFF), amongst others. Project updates were also shared via the Defra stakeholder bulletin, and regular communication with stakeholders was maintained via a dedicated email address.

January 2023

Seabass Fisheries Management Plan (FMP) 2023

Project report

Project Team

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Matteo Menapace

POLICY LAB

Department for Environment Food & Rural Affairs

This is the final report for the collaboration between Defra, Welsh Government and Policy Lab on the seabass FMP project that took place between March 2022 and December 2022.

This report is one of the four reports submitted by Policy Lab to Defra and Welsh Government.

It provides a summary of key findings and recommendations that were co-designed with stakeholders over the course of the last eight months of the project.

Policy Lab is a multidisciplinary team working openly and collaboratively across government, bringing expertise in policy, ethnography, systems thinking, futures and design.

We support the public sector to achieve better policy outcomes by partnering on innovative projects, leading and demonstrating best practice, and delivering training.

Since 2014, we have partnered with policy teams on over 200 projects, working with 7,000 public servants across central and local government departments and agencies, as well as internationally.

Policy Lab is multi-award winning, and one of the world's longest-standing government Labs dedicated to policy innovation.

Our projects test new approaches which bring lived experience and experimentation into policymaking. We share our new tools and techniques openly on our blog and the Open Policy Making Toolkit to encourage system-wide transformation.

Read more about our work in our prospectus and on the website.

Contents

Context

Seabass stock is unique, iconic and a highly valuable non-quota species. Ten years ago, stocks plummeted, so specific science-led management measures were put into place. These measures have helped but there is still the need to manage the current stock levels, which affects recreational and commercial fisheries.

Seabass is a valuable fish stock for recreational fishing and brings in high retail prices for commercial operators. It is very important for coastal communities and the rules and regulations surrounding the pressures of fishing are messy.

There are multiple stakeholder groups with diverse voices, priorities and challenges, which has historically resulted in tension and polarisation. Defra acknowledged the voices that had been previously heard by the government did not always represent the entire industry.

Seabass is largely an English and Welsh interest, with the South West of England being particularly vocal on doing more for seabass and the industry. Scotland and Northern Ireland are less interested, though seabass is now being sighted in the North East of England. It is highly political topic, with the interest in English and Welsh seabass extending beyond the national borders as it is attracting interest from various European countries.

Context (continued)

Trust has been a major issue between the catching sector, Defra and the Trade and Cooperation Agreement (TCA), with assertions regarding EU Exit. However, alongside the existing challenges there is a huge wealth of experience, innovative thinking and willingness to look forward amongst the stakeholders.

The UK is coming out of decades of top-down processes and are now moving to engagement, consultation and co-design, with a clear aim of finding methods that capture as many voices as possible, providing a starting point for discussion and rebuilding trust between the government and stakeholders.

Prior work and research were carried out to develop collaborative regional fisheries groups. Defra, the Marine Management Organisation (MMO), and the national fisheries authority, had a renewed focus to work towards co-management. In 2010, new governance models were set up to support regional management - the Inshore Fisheries and Conservation Authorities (IFCA).

Against this backdrop, Defra and Welsh Government have commissioned Policy Lab to facilitate a co-design process with regulators, scientists and fisheries to work together and find solutions for the new seabass Fisheries Management Plan (FMP), which balance social, economic and ecological requirements.

Challenge

Policy Lab was tasked to facilitate a co-design process for a national plan for seabass management, working with key stakeholder groups to build trust, address fatigue and create both a user-centred and nature-centred policy.

Policy Lab worked together with key internal stakeholders to frame these initial challenge statements (Right).

HOW CAN WE...

"co-design a new national plan for seabass management in order to ensure this valuable natural resource can benefit a diverse range of commercial, personal and political interests, whilst ensuring stocks remain sustainable and in the process foster empathy and trust between those involved? "

"replicate the approach taken to developing this national plan to manage other marine species?"

Project Timeline

Evidence Discovery and Expert Interviews
(March - May '22)

Lived Experience Research
(June - August '22)

Collective Intelligence Debate
(August '22)

Co-Design
(September - November '22)

Co-Refine
(November - December '22)

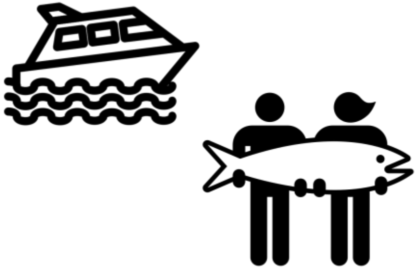
Methodology in brief

- **Expert interviews:** The initial expert interviews with 13 individuals helped us shape our understanding of the challenges at hand and the stakeholders we would be engaging with. Expert interviews informed our decisions on the methods and locations for the lived experience research phase.
- **Lived experience research:** Split between seven locations, lived experience research used a combination of pop-up research and in-depth ethnographic (researchers spend time observing people's everyday lives) approaches to explore various challenges and opportunities of seabass fishing as perceived by stakeholders themselves.
- **Collective intelligence:** A week-long online debate brought together a diverse group of stakeholders from across England and Wales to sense-check and build on the insights from the lived experience research and tried to match some of the challenges with potential solutions.
- **Co-design:** Policy Lab facilitated nine face-to-face and online workshops, which involved scenario testing with seabass stakeholders, using challenge and idea cards. The purpose of the workshops was to form a sensible set of FMP solutions and to work through areas of agreement and disagreement between stakeholders. We also circulated an online survey to allow a greater number of stakeholders to engage in the same scenario-planning exercise.
- **Co-refine:** Built on the outcomes of co-design, Policy Lab organised a workshop with internal government stakeholders and agencies to sense-check the solutions. The final options were shared with a wide group of stakeholders for the final round of sense-checking and comments.

Expert interviews

Policy Lab conducted interviews with 13 key stakeholders who were identified through our engagement with Defra and Welsh Government, desk research and initial stakeholder mapping.

These helped us shape our initial understanding of the challenges at hand and informed our decision on the methods and locations for the lived experience research phase.



We spoke to **recreational fishers** to understand the role of seabass fishing for people's lives and their communities, as well as its impact on tourism and conservation.

NATURAL ENGLAND

Marine Management Organisation

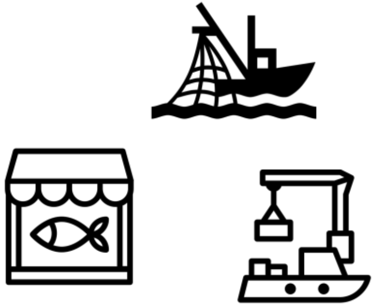
Department for Environment Food & Rural Affairs

Llywodraeth Cymru Welsh Government

seafish

Cefas

We spoke to **government representatives and regulators** about the current rules and regulations, their enforcement and monitoring as well as their interactions with the EU.



We spoke to **commercial fishers** about the importance of seabass fishing for their livelihood, and about how the existing regulation has been impacting their fishing activities.

Lived experience

Split between eight locations, lived experience research used a combination of pop-up research and in-depth ethnographic approaches to explore various challenges and opportunities of seabass fishing as perceived by stakeholders themselves.

We engaged with over 70 commercial and recreational fishers in Pembrokeshire, Stoke-Gifford, Brighton and Shoreham, West Mersea, Barrow-in-Furness and Seaton-Carew. In addition to conducting shorter interviews with fishers, we also spent half a day or a full day with selected individuals from different stakeholder groups , including recreational anglers, rod and line commercial fishers, netters, trawlers and

Spending time with fishers on the ground helped Policy Lab understand the most important issues for the FMP.

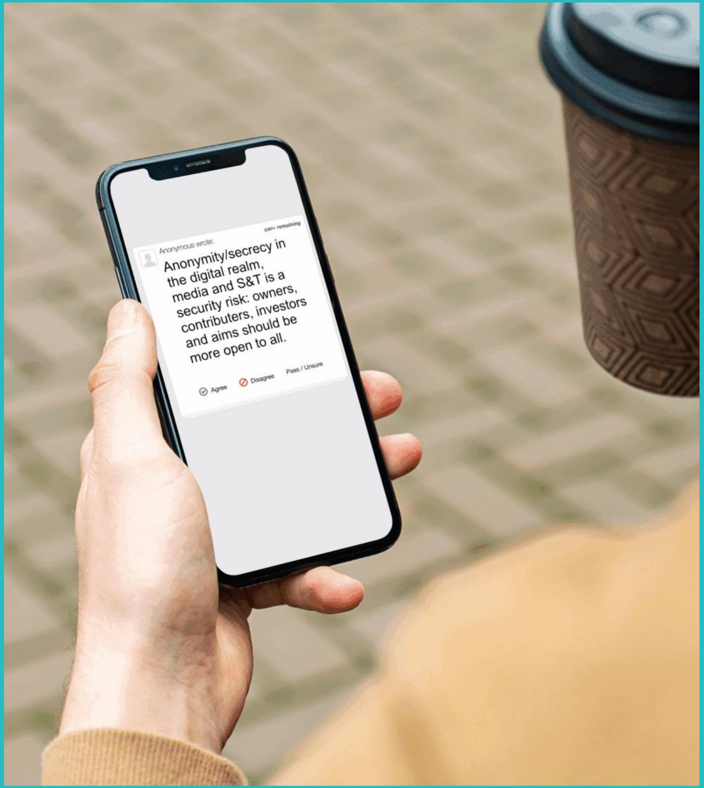
Filleter at Newlyn Market

Collective intelligence

Following the lived experience research, Policy Lab conducted a week-long online debate, which brought together over 280 stakeholders from across England and Wales.

A highly diverse group of stakeholders voted on 711 statements, most of which were submitted by stakeholders themselves and moderated by Policy Lab to remove duplication and ensure clarity.

The statements helped to sense-check and build on the insights from the lived experience research and tried to match some of the challenges with potential solutions. The combination of lived experience insights and stakeholder-led collective intelligence voting data and ideas informed the subsequent phases of the project.



Example of the Collective Intelligence platform

Co-design

The purpose of the co-design workshops was to form a sensible set of FMP solutions by working through 'Challenges' and potential 'Solutions' in the form of interactive in-person and online workshops, and a survey.

Policy Lab worked closely with Cefas, Defra and Welsh Government to develop key challenges and solutions on the basis of the insights from the lived experience research and collective intelligence debate. It was not possible to include every single area of interest, and we had to focus on the issues that were deemed a priority by stakeholders from different sectors.

The nine co-design workshops brought together different stakeholders to the same table to discuss feasible solutions for the FMP. The same scenarios were also presented to the stakeholders in the form of a survey, which attracted 477 responses.

Photograph from one of the co-design workshops

Co-refine

The voting data from the workshops and the survey helped us understand the areas of agreement and disagreement on the key challenge areas. Whilst some challenges were matched with clear solutions, some others didn't have a strong stakeholder consensus.

We presented the outcomes of the co-design process to a range of internal stakeholders, including Cefas, Defra, Welsh Government and relevant arms-length bodies with an interest and expertise in seabass fisheries. The experts' insights helped us understand which solutions would be feasible and implementable in the short-term, and which required a more long-term approach. They also helped us identify the gaps in knowledge.

We formed the final high-level recommendations on the basis of these conversations and played them back to stakeholders via an online survey. We asked stakeholders specific questions about how these solutions could work for them by seeking practical suggestions. These informed our final recommendations. The survey attracted 449 responses.

Locations

Policy Lab visited the eight locations for the lived experience research phase, followed by additional three locations for the **co-design workshop**.

These locations were chosen in consultation with various stakeholders, in particular with expert interviewees and representatives of Defra and Welsh Government arms length bodies with an interest and stake in seabass fishing.

Policy Lab ensured a wide geographical coverage and engagement through various online stakeholder activities, which brought together stakeholders from across England and Wales.

Stakeholders

Throughout the project, it became apparent that the seabass stakeholder landscape is not only incredibly diverse but also fragmented. Different stakeholder groups often don't interact directly and there is an inherit animosity between different parts of the seabass system. This has made the engagement not only more challenging but also more important. Identifying areas of consensus and compromise between different stakeholder groups in a collaborative fashion is what can ultimately make the upcoming FMP successful. Over the course of our engagement, Policy Lab engaged with the following groups:

- **Commercial fishers**: seabass licence holders; members of various co-ops; individuals who came forward via our online form and pop-up research; and individuals we were put in touch with via gatekeepers (local IFCAs, MMO, other fishers etc);
- **Buyers/sellers of seabass/market owners**: as above, also individuals who were identified through online research/commercial websites;
- **Recreational fishers**: members of different angling associations at a national and local level; individuals who came forward via our online form and pop-up research; and individuals we were put in touch with via gatekeepers;
- **Charter boat skippers:** as above; also individuals whom we identified through online research/commercial websites;
- **Enforcement bodies**: MMO and IFCA representatives working locally and nationally;
- **Seabass scientists:** Cefas; individuals, research organisations and academic institutions in England and Wales identified via Defra, Welsh Government, arms length bodies and online research;
- **Environmental organisations**: identified through Defra, Welsh Government and trusted arms-length bodies;
- **Internal stakeholders**: Defra, Welsh Government, arms length bodies with an interest and stake in seabass fishing.

Stakeholder Engagement

Interviewed

13

sea bass experts

280

Participants joined the collective intelligence debate

More than 90

stakeholders engaged in the lived experience research - where we visited eight locations

477

responses to the online co-design survey

70+ **participants joined the co-design workshops**

Co-refine survey response

449

Total Engagement

1400+

1. Vision and objectives of the FMP

This short section presents the vision of this FMP. The vision is distilled from the conversations and insights from stakeholders across the seabass system, and it outlines the kind of regulatory framework that stakeholders would like to see and work towards.

Based upon the vision of the FMP, this section also identifies key objectives that the new FMP should aspire to achieve. These are: stock level objectives; wider environmental objectives; wider social and economic objectives; and fair allocation of fishing opportunities and licensing.

Vision

The long-term vision for this FMP, created by stakeholders through this project, is for the seabass fisheries in England and Wales to be **managed sustainably and responsibly** in order to restore and maintain healthy seabass stock levels and ensure that seabass fishing is future-proofed.

The impact of fishing on **the wider environment** and its contribution to climate change will also be better understood and mitigated and so will **the socio-economic potential** of seabass fisheries.

This FMP will take into account the diverse stakeholder landscape and ensure that **access to seabass fishing is co-managed and fair** for different stakeholder groups, in line with the wider sustainability goals, set out in the Fisheries Act 2020.

Achievement of this vision will be delivered **collaboratively with different stakeholder groups, transparently and objectively, and by taking an iterative approach**.

To deliver this, **an evidence-based approach** will be adopted, and management measures will be implemented using the best available evidence. Where there is not sufficient evidence available, the precautionary approach will be applied. The plan will also identify evidence gaps and detail how these will be addressed, and where appropriate, reviewed and revised.

Objectives of the FMP

To achieve the vision of the FMP, the plan will focus on the following objectives:

- **Stock level objective:** One of the key objectives of the FMP is to restore the healthy seabass stock levels across England and Wales, and to ensure that these are sustained through a responsible long-term management of recreational and commercial fisheries.
- **Wider environmental objective**: It is essential to understand how seabass fisheries impact the wider marine environment to identify and minimise any negative interactions. This will protect the wider marine ecosystem, as well as improve industry reputation.
- **Wider social and economic objective:** Strengthening current markets provides greater business resilience and can positively benefit individuals involved in seabass fishing as well as wider coastal communities.
- **Fair allocation of fishing opportunities and licensing:** In light of limited seabass stock levels, it is paramount that the FMP establishes a fair system, which opens access and fishing opportunities to a diverse range of stakeholders.

Summary of recommendations

1. Stock level objective

1.1 Work with scientists, stakeholders and policy makers to gather further evidence, using collaborative approaches, to prioritise a management system that maximises the long-term societal benefits, while ensuring sustainability.

1.2 Introduce a slot size system for landing seabass commercially and recreationally to protect the breeding stock (eg. minimum size 42cm, maximum size 60cm - exact measurements to be decided in consultation with scientists).

2. Wider environmental objective

2.1 Prioritise the use of more environmentally sustainable fishing methods to catch seabass, such as rod and line, over other methods, like trawling, that pose wider environmental risks to sensitive species and habitats.

2.2 Prioritise the use of novel technologies to manage discards.

2.3 Prioritise catching all seabass where survival rates are low to prevent the waste of dead fish (fishers would not be able to retain profits upon sale).

____

Summary of recommendations

2.4 Use closed seasons to protect spawning aggregations of seabass stocks that reflect changes in timings of spawning in different areas.

3. Wider social and economic objective

3.1 Prioritising local coastal communities. This encompasses supporting all parts of the local seabass system, ranging from commercial fisheries to recreational angling and the wider local ecosystem (tourism, hospitality, supply chain etc).

4. Allocation of Fishing Opportunities and Licensing

4.1 Ensure access to fishing opportunities is balanced between recreational and commercial fishers in proportion to the benefit they generate.

4.2 Maintain the existing seabass authorisation system and reference period while the seabass stock fully recovers, but actively explore alternative approaches within a specified timeframe following publication of the FMP.

Summary of recommendations

4.3 Keep seabass accessible, with no licence to catch recreationally (within agreed bag limits), but with the potential to consider a national licence for recreational sea angling as stocks recover in future.

5. Fishery management strategy and monitoring

5.1 Simplify regulations to improve compliance and enforcement and increase efficiency, where possible and when appropriate. This is with the caveat that regulations should also be clearly communicated and easily accessible to all.

5.2 Focus on prioritising a mostly national plan, somewhat regional so all seabass rules apply throughout England and Wales, however authorities could make relevant regional byelaws (similar to the current system) to reflect local differences.

5.3 Prioritise adaptive approaches being developed where fishers, scientists and policy makers come together to identify priorities and strategies for monitoring and assessment, responding to new opportunities and updating the FMP in the context of the International Council for the Exploration of the Sea (ICES) advice.

1. Stock level objective

Stakeholders are in agreement that sustainable seabass stocks are a priority but opinions on how stocks should be managed across England and Wales are divided. There is consensus that stock level objectives need to be science-led and that improving the evidence needs to be a priority. Stakeholders were unanimous about policy needing to be developed with fishers, scientists and policy makers to identify priorities and strategies for monitoring and assessment.

There is confusion around the varying definitions for managing stocks and differentiating between the options, as they are not felt to be mutually exclusive. Stakeholders reflected on needing clarification around the objectives with careful consideration as to what sustainable, conservation, ecosystem and societal mean. Some stakeholders would also like to introduce a slot size system for landing seabass to protect breeding stocks, exact measurements need to be decided in consultation with scientists and stakeholders.

In the co-design workshops, stakeholders were united that long-term societal benefits need to be prioritised to recognise the wider benefits of seabass. However, in the co-design survey stakeholders were divided, prioritising the amount that can be caught in a sustainable manner and conservation and ecosystem benefits, over societal benefits. The varying priorities need further discussion with Defra, the Welsh Government and Cefas to establish how the evidence base could be improved to ensure a science-led approach for seabass stock management.

Insights

- Most stakeholders agree that the past 'free-for-all' approach with no regulation in place for seabass fishing had a detrimental impact on seabass stock.
- According to many stakeholders, the emergency measures put in place for seabass fishing have successfully promoted seabass stocks across England and Wales. However, some recreational fishers disagree and believe that the current seabass stock levels continue to be too low.
- Some commercial fishers consider seabass stocks are now at the level where some rules and emergency measures could be relaxed, in favour of less regulated commercial fisheries.
- All stakeholders want to prioritise adaptive approaches to work together with scientists and policy makers from the outset, to co-design policy management from the ground up.
- Statements in the online debate considered what the high-level strategies should be for the fishery, with many stakeholders focusing on stock strategies such as Maximum Sustainable Yield (MSY), Large Stock or those which address the stock structure, as well as other strategy approaches such as maximum social benefit and maximum economic yield.
- There was some agreement that a slot size system should be introduced to protect breeding seabass. Defra, Welsh Government and Cefas need to investigate this further and discuss with stakeholders.

Risks

"Scientists now say MSY is the limit to be avoided. Bit like driving your car at 9000 RPM - doesn't mean you should do it, even though you can"
Co-design workshop participant

- There is a risk with prioritising MSY in the short term as many stakeholders referenced it's failure around the world. Many stakeholders are not convinced that MSY delivers sustainable outcomes.
- There is a risk of confusing stakeholders with terminology surrounding stock level objectives. Stakeholders stated the lack of clarity regarding what the objectives actually mean and how they would be implemented.
- The progression to societal and ecosystem benefits for use in the longer term needs to be led by evidence and developed collaboratively using adaptive approaches, within an agreed time frame, to avoid the risk of stakeholders not feeling they are part of the process.
- Some stakeholders are concerned that introducing a slot size could lead to more discards, this requires further investigation.

Opportunities

- There is an opportunity to collaborate with fishers on future seabass stock management to ensure that the science behind methods is developed with fishers on the ground, using adaptive approaches.
- MSY is not easy to define and meet but some environmentalists felt that if you get that right, there is the opportunity to have a sustainable fishery. This would not be in isolation of other options, maximising societal benefit and ecosystem approach come in tandem - they suggested a concept of 'MSY plus'.
- There is an opportunity to move away from MSY to recognise the wider benefits of seabass. Stakeholders in the co-design workshops predominantly agreed with moving to maximising the long-term societal benefits that are generated by the stock, while ensuring sustainability.
- Introducing a slot size system could help protect breeding stocks and has been a successful strategy in other countries. Exact measurements (minimum and maximum) needed to be decided on consultation with scientists and stakeholders.

I want to see sustainability as key - without that nothing works

Co-design workshop participant

Fish are part of our natural capital. As a matter principle, they should be exploited to benefit most in society

Co-design workshop participant

Recommendation 1.1

System wide change

- **Work with scientists, stakeholders and policy makers to gather further evidence, using adaptive approaches, to prioritise a management system that maximises the long-term societal benefits, while ensuring sustainability.** This approach encompasses recognising the wider benefits of seabass from commercial fisheries to recreational angling and the wider local ecosystem (tourism, hospitality, supply chain etc).

- Prioritising the long-term societal benefits generated by the stock was the most popular approach in the co-design workshops, with **six out of nine workshops** voting in favour of this priority. However this approach only had **18% of the votes in the survey**, versus MSY with **35%** votes and conservation and ecosystem benefits with **35%** votes.

Recommendation 1.1

System wide change

Next Steps

- Using adaptive approaches, gather further evidence to prioritise a management system that maximises the long-term societal benefits, while ensuring sustainability.
- There is consensus that stock objectives need to be science-led and that improving the evidence needs to be a priority.
- Many stakeholders felt the stock objective options were not mutually exclusive and are calling for further clarification on the varying definitions and how they would be implemented.
- Stakeholders asked for a time frame for moving from the current MSY system to societal benefits, while ensuring sustainability.

System Wide Change

Transition stock objectives to a system that maximises the long-term societal benefits, while ensuring sustainability, working with scientists, stakeholders and policy makers to recognise the wider benefits of seabass.

“I think a balance of all (options) would be best, prioritise what is the best thing overall in terms of long-term societal benefits, working out the best balance between rec and commercial benefits. Beyond that, prioritise the ecosystem because if you prioritise seabass for sake of seabass then MSY, which is a construct of science and politics, falls into place because if the stock is healthy then profits are generated at the end and profits look after themselves”

Co-design respondent

“I believe a slot size would benefit my fishing in the longer term by allowing stocks to regenerate”

Co-refine respondent

Recommendation 1.2

Quick win

- **Introduce a slot size system for landing seabass commercially and recreationally to protect the breeding stock (eg. minimum size 42cm, maximum size 60cm - exact measurements to be decided in consultation with scientists).** This encompasses recognising the wider impact on commercial fisheries to recreational angling and the wider local ecosystem (tourism, hospitality, supply chain etc).

- Prioritising a slot size system was introduced following the co-design phase as this was a widely discussed subject area and had been raised in collective intelligence statements too. Therefore, **a question was included in the co-refine survey** to gather stakeholders views.

Recommendation 1.2

Quick win

Next Steps

- Use the upcoming public consultation to gather further views of a potential slot size system and how this would impact landing seabass commercially and recreationally.
- Liaise with scientists to define the minimum and maximum measurements, based on the impact of the slot on the stock levels.

"Scientists alone cannot do this, there needs to be significant input from interested third parties"

Co-design respondent

"We would support this approach (MSY) but the ability for some degree of regional variation should be considered. 'Caught in a sustainable manner' will need careful consideration as to what it means (environmental, economic, societal, communal benefit). 'Ecosystem benefits' are complex as there is often a trade off to be made where something loses and another gains. The balance point needs to be decided and then management can deliver the desired outcome. These considerations will deliver societal outcome'"

Co-refine respondent

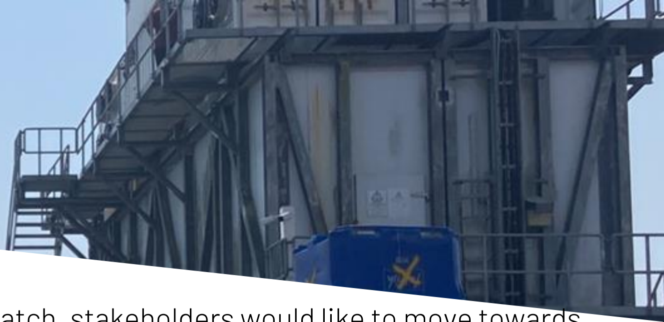
POLICY LAB | Department for Environment Food & Rural Affairs

2. Wider environmental objectives

As part of a wider UK effort to promote sustainable fishing, commercial and recreational seabass fishing restrictions have been put in place to protect this widely popular and threatened species. Within this context, It is essential that seabass fishing activity minimises its impacts on the marine environment and any negative interactions with it to protect the seabass stock, the marine ecosystem structure and functioning, as well as to improve the reputation of the seabass fishing industry.

Seabass stakeholders agreed that the seabass stock should be kept at a sustainable level and that fishing should not impact any other species or the wider environment. Nevertheless, commercial fishers flagged the economic impact of current restrictions and emphasised that any further measures would seriously compromise their business or employment.

There is a consensus amongst stakeholders across a range of approaches for the new seabass FMP's wider environmental objective including: the use of more environmentally sustainable fishing methods and novel technologies for the protection of the environment and seabass stocks; the use of fishery closures to protect spawning aggregations; and the move from a bycatch approach to a fairer and more clearly defined catch limits approach.



Insights

- All stakeholders agree that seabass conservation that is part of the wider environmental objective is essential to preserve the environment, coastal communities and the livelihood of fishers.
- Stakeholders are calling for the promotion of sustainable fishing gear and the phasing out of damaging fishing methods. However, not all commercial fishers agree on which methods are sustainable or not. For example, some would ban netting altogether whilst other would not.
- Most commercial and recreational fishers are in support of science-led measures to protect seabass and the environment but their knowledge level in science and government is usually low. For many commercial fishers in particular, the lack of trust comes from their own day-to-day observations, which allegedly don't match the scientific data.
- Regarding bycatch, stakeholders would like to move towards a catch limits approach as they feel the current bycatch approach is not achievable nor clearly defined.
- A range of possible ideas were also expressed for how fishers should use seabass caught as bycatch (e.g. catches might be given to food banks and care homes).
- As for the closed season most agree that this approach supports the seabass stock and its spawning but there are some disagreements on the current duration and time of the year.
- Some stakeholders would like to see a local approach to closed seasons and real-time closures, as one size fits all approach cannot necessarily work across the country but some worry this may add additional regulations in a sector that is already heavily regulated at the local and national level.

Risks

"Limited closed seasons would undoubtedly protect stocks, especially during spawning periods, but this should be coupled with an improvement and strengthening of seabass nursery areas, to protect juvenile fish."

Co-design survey respondent

- There is a consensus across all seabass stakeholders that super trawlers and international large fishing corporations are the most damaging to the environment.
- All stakeholders are concerned that if these large operations are not more regulated and enforced, new seabass FMP measures to protect the seabass stock and the wider environment will not be enough on their own.
- Stakeholders expressed that closed seasons of fisheries need to be carefully planned and science-based to both minimize potential burden of additional local bye-laws and to respect the different seabass spawning seasons across the UK.
- Some recreational fishers argue that nursery zones should be off-limits to all commercial fishing to preserve the environment and seabass stock.
- Although survey respondents are in favour of prioritising the landing of all bycatch of seabass to minimise discards many stakeholders are concerned that it may incentivise fishers to catch more seabass than they should.

Opportunities

- There is a consensus across all stakeholders that preserving seabass for a sustainable stock and wider environment objectives should be a priority for the new seabass FMP.
- Throughout the engagement, both recreational fishers and commercial fishers gave us examples of choices they are making for the purpose of a healthier seabass stock and a sustainable wider environment (e.g. switching to more sustainable gear; not scaling up fishing operation).
- Many commercial fishers are already engaging with scientists and would welcome more collaborations between scientists and fishers towards a better understanding and preservation of the seabass stocks and the wider environment.
- Part of the recreational fishers stakeholder group is open to pay an annual licence fee for seabass fishing with the funds contributing to the preservation of seabass.

If you want to control seabass stocks first thing would be to stop the super trawlers off the coast of […] scooping all the breeding fish all year round.

Co-design survey respondent

For reasons of food production and livelihoods for those in the sectors it is important that a viable commercial fishery is maintained that employs targeted methods without wider environmental damage.

Co-design survey respondent

Recommendation 2.1

System wide change

- **Prioritise the use of more environmentally sustainable fishing methods to catch seabass, such as rod and line, over other methods, like trawling, that pose wider environmental risks to sensitive species and habitats.**

- **Six out of nine** co-design groups and **61%** of all respondents voted for this approach making it the most favoured approach across all stakeholders.

Recommendation 2.1

System wide change

Next Steps

- Use the public consultation to explore the definitions of sustainable gear, as the stakeholder views on this issue continue to be divergent.
- Engage with scientists to further sense-check the definitions of sustainable fishing methods.
- Use the public consultation to explore the appropriateness of different types of gears in different regional context to determine whether a regional as opposed to national approach would be more feasible.
- Use the public consultation and other upcoming stakeholder engagement opportunities to explore how government could support the commercial sector to shift towards more sustainable fishing methods in order to mitigate any financial and job losses.

System Wide Change

- Use further iterations of the FMP, over time, to promote a gradual but continuous shift towards sustainable fisheries, whilst ensuring that the industry has sufficient support to accommodate the changes.

"Prioritising environmentally sustainable fishing methods, such as rod line, is a key tactic that will help to achieve the overall goal of minimising impact and building ecosystem resilience."

Co-design survey respondent

"The issue is not the method [netting] itself [...] but the sheer amount of it that is going on, it is way too much and certain areas which are known to be seabass gathering areas should have a netting ban put in place."

Co-design workshop participant

Recommendation 2.2

System wide change

- **Prioritise the use of novel technologies to manage discards.** The existing and emerging technological innovations in the field of fisheries - ranging from smarter tracking devices to sonic and light solutions for avoiding certain species, could help fishers target their catches more efficiently, thus minimising discards. The development, testing and implementation of such technologies need further support.

- **Four out of nine** co-design groups agreed that prioritising the use of novel technologies for managing discards was the best option, making this approach the most popular one in the workshop setting. This compares to **23%** of survey respondents who voted in favour of this approach - the second most preferred option.

Recommendation 2.2

Quick win

Next Steps

- Consult the industry, via the public consultation and beyond, about the existing trends that could be piloted and rolled out nationally.
- Liaise with scientific community and the industry nationally and internationally to explore novel technologies that could minimise seabass discard.
- Explore how the development, testing and implementation of new technological solutions could be encouraged via funding, tax incentives, collaborations between the industry and the academia etc.

"We need to find ways [including novel technologies] to minimise the tragic death of hundreds of tonnes of juvenile seabass."

Co-design survey participant

"The use of novel technology has merits, I understand that 95% of discards are juvenile seabass and it is essential that if all are landed, it does not encourage commercial fishermen to continue targeting areas where juvenile seabass are, or for them to exceed their catch allowance."

Co-design workshop participant

Recommendation 2.3

System wide change

- **Prioritise catching all seabass where survival rates are low to prevent the waste of dead fish. However, caveat that fishers would not be able to retain profits upon sale.**

- **Two out of nine** co-design workshop groups opted for the approach of landing all seabass as their collective priority. This approach was the most popular option in the survey with almost one third of respondents **(27%)** choosing this option as their favourite potential solution for addressing the challenge of discards.

Recommendation 2.3

System wide change

Next Steps

- Explore the potential tools for monitoring seabass discards. An option could be added on the Catch-App and on all catch records processes for fishers to be able to communicate to MMO and IFCA their seabass discards.
- Look at international examples of how discards are managed effectively, both in terms of monitoring discards and managing the landings.

System Wide Change.

- Use the evidence of discards in English and Welsh waters in relation to different types of vessels, gears and geographical area, to ensure that the future regulation in this space responds to live issues effectively.

"We can not know what is being discarded or not. The only way to understand the extent of stock damage is to see what is actually being caught, so all should be retained and landed.

Co-design survey respondent

"I don't know how this would work in practice but if it meant that all catches and discards were accurately monitored it sounds like a good idea."

Co-design workshop participant

Recommendation 2.4

System wide change

- **The recommendation is for the FMP to use closed seasons to protect spawning aggregations of seabass stocks that reflect changes in the timing of spawning in different areas.**

- In co-design workshops, **five out of nine groups** voted in favour of closed seasons to protect spawning aggregations of seabass stocks and in the survey, **41%** of all respondents said that the closed seasons approach was their preferred way forward for reducing environmental impact of seabass fisheries.

Recommendation 2.4

System wide change

Next Steps

- Continue to liaise closely with scientists to understand the migration patterns of seabass and the effects of global warming to define closed seasons.
- Ensure that any spatial-temporal closures are effectively communicated to the fishing communities locally and nationally to avoid unnecessary breaches of the rules.

System Wide Change

- Support stronger collaboration between scientists, policymakers and fishers on the ground to assess whether local, national or real time closures could help protect spawning of seabass whilst minimising their impact on fishing activities.

"No point in just having local regulations only for a neighbouring region to undermine them."

Co-design survey respondent

"Closed seasons can be effective and if matched with science can be reactive as well as proactive - needs to be done by area however and not across the UK as seabass spawn in different areas and at different times."

Co-design survey respondent

Recommendation 2.5

System wide change

- **The recommendation is for the FMP to prioritise implementing catch limits rather than unavoidable bycatch (while remaining aligned with FMP stock objectives and ICES advice).**

- This was by far the most popular option in co-design workshops and in the survey alike. **Six out of nine** workshop groups opted for the option of implementing catch limits as their collective priority. This was reflected in the survey, with **45%** of respondents favouring this approach.

Recommendation 2.5

System wide change

Next Steps

- Use the public consultation to explore how a catch limit could be implemented in practice.
- Use the public consultation to explore whether vessel size should be considered when defining a catch limit. Whilst the existing bycatch regulation does not take it into account, industry stakeholders are calling for the scale of the fishing operation to be factored in.
- Ensure that any future regulation is clear and precise to avoid confusion and alternative interpretations, as per the current 'unavoidable catch' terminology.

System Wide Change

- Collaborate with scientists and fishers to identify whether a catch limit or quota approach would work best in England and Wales moving forward, and how it could work for a variety of vessel sizes.

"Unavoidable [catch is] too vague. Catch limits could be the total amount of fish that can be removed from the fisheries. [It's] important to identify allocations - what are the most sustainable methods and what can achieve max yield."

Co-design workshop participant

"Catch limits are better than quota. As soon as you have quota, it becomes a commodity, then people start to abuse the system."

Co-design workshop participant

3. Wider social and economic objectives

Seabass is deemed a particularly important fish due to its popularity with British and foreign consumers, high market prices, appealing fishing experience for recreational anglers and its historical legacy for English and Welsh coastal communities.

Against this background, many stakeholders have reflected on what social and economic benefits of seabass fishing should be prioritised in the new FMP. Whilst some have argued for prioritising commercial fishers whose livelihoods are contingent on seabass, others talked in favour of national GDP and food chain, and some others for recreational fishing opportunities.

However, throughout the process of research and co-design, stakeholders appeared to be united in a shared goal of prioritising socio-economic and cultural benefits for local communities. Not only do these communities encompass both commercial and recreational fishers; **they also ensure the sustainability of villages and towns along the often-impoverished Welsh and English coast, where seabass fishing provides a living for families and communities beyond fishers.**

Insights

- Stakeholders pointed out a number of socio-economic benefits of seabass fishing at a personal, social and community level.
- On a personal level, commercial fishers pointed out the importance of seabass for their income. Seabass is a highly profitable and popular fish in England and Wales and demands a premium.
- On a wider social level, commercial fishers and seabass sellers pointed out the importance of seabass fishing for national food security and the food supply chain. They spoke about high numbers of jobs that support the fishing sector, ranging from filleters to market personnel to the boat crew.
- Recreational anglers talked about the importance of angling for local economies. From tackle shop to fishing competitions and charter boats, recreational fishing is said to be crucial for the existence of thriving coastal communities.
- Recreational fishers also spoke about the indirect benefits of seabass fishing; for example, a number of fishers we met pointed out the mental health benefits of fishing. In their words, this in turn alleviates the pressure on the NHS and other services.
- Stakeholders also spoke about the historical importance of seabass fishing in England and Wales. Not only is this important for cultural heritage of coastal communities; it also attracts lucrative tourism business to often impoverished coastal villages and towns.

Risks

"Commercial fishermen NEED to be able to catch seabass to survive. The only realistic benefit to the UK economy is the landing of seabass, which is then sold to the food industries, which in turn pay taxes at every step"

Co-design survey respondent

- Fishers pointed out the disparities in the perception of socio-economic benefits for different stakeholder groups; whilst for most commercial fishers it is linked to maintaining their livelihood, some recreational fishers pointed out wider impacts on tourism and hospitality as well as health benefits of fishing.
- Many commercial fishers raised the importance of prioritising commercial fisheries. Not doing so, risks impacting individual fishers as well as the wider supply chain and national food security.
- Recreational fishers spoke about the risks of focusing solely on commercial fishing activities. By doing so, one ignores positive socio-economic impacts of recreational seabass angling, which has monetary value and is beneficial for the health of individuals and local communities.
- Environmental organisations and some other stakeholders spoke about risks of putting socio-economic benefits before wider environmental benefits and flagged the importance of balancing the two objectives.
- Stakeholders across the seabass system talked about the risk of prioritising one sector over another, and generally argued for a balanced approach.

Opportunities

- Prioritising the socio-economic benefits for local coastal communities was deemed a holistic approach, which doesn't benefit only one sector but wider communities.
- Stakeholders talked about the importance of prioritising healthy local communities over focusing on national benefits. Getting it right at a local level will contribute to a positive national seabass landscape.
- Stakeholders mostly agreed on the importance of balancing different sectors and recognising that seabass fisheries can have multiple positive impacts at an individual, communal and societal level, ranging from livelihoods to tourism and hospitality businesses and mental health, to mention just a few.
- Coastal communities are often some of the most impoverished in England and Wales. Prioritising healthy local infrastructure, local jobs and a thriving tourism sector can benefit these communities in a positive way.

I don’t think we should choose one sector over another, and we should think about benefits to local communities, which are most deprived in the country.

Co-design workshop participant

I don’t like divisive options; we need to come together. If you go for local communities, you contribute to national economic growth and everything.

Co-design workshop participant

Recommendation 3.1

System wide change

- **Prioritising local coastal communities. This encompasses supporting all parts of the local seabass system, ranging from commercial fisheries to recreational angling and the wider local ecosystem (tourism, hospitality, supply chain etc).**
- Prioritising the benefits for local coastal communities was by far the most popular approach in co-design workshops, with seven out of nine workshops voting in favour of this priority. This approach was popular in the survey as well, where 29.1% of respondents favoured this option.

Recommendation 3.1

System wide change

Next Steps

- Use the upcoming public consultation to gather stakeholders' views on how to measure impact and benefits for local communities. For example: according to stakeholders, suitable methods include socio-economic study and supply chain economic assessment; surveys of local fishers and other businesses (tourism, hospitality); and economic growth in local areas.

System Wide Change

Government to collaborate with local fishers, industries, hospitality businesses and other relevant entities to monitor and measure positive impact of seabass fishing on local communities.

"I believe the benefits of keeping the fishery for all stakeholders will be huge. I have seen a decline in commercial fishermen along the south coast since the measures have come in force mainly caused by not having access to the seabass fishery and also the prices of boats with the authorisation have risen too high. Getting the FMP right could give coastal towns the boost they need again."

Co-refine survey respondent

"A fishery with a healthy sustainable population of large seabass would generate angling tourism with benefits to the local economy and accommodation as well as the specialist angling supply trade."

Co-refine survey respondent

4. Allocation of Fishing Opportunities and Licensing

Stakeholders tell us that historically seabass saw an alarming decline in their numbers, leading to unprecedented measures and regulation for recreational fishers and the commercial fishing industry across England and Wales, including restrictions on who has access to fish for seabass. Discussions on access to seabass fishing continue to be a contested subject amongst the stakeholders. This section covers stakeholders' views on:

- How access to seabass fishing should be allocated;
- How commercial licensing should be regulated;
- The future of licensing recreational fishing.

In short, the recommendations for the new FMP are to keep the seabass fisheries open to the commercial and recreational sector and partition it according to the benefits that they generate. The recommendation is also to maintain the status quo for the existing licensing regime for commercial vessels, whilst actively exploring alternative approaches once seabass stock levels are recovered. The final recommendation in this section is to enable recreational seabass anglers to continue fishing without a licence (within the existing bag limit), while exploring the potential of introducing a licence in future.

Insights

- Discussions on access to seabass fishing continue to be a contested subject amongst the stakeholders, with recreational fishers and commercial fishers often arguing for their sole access to seabass fisheries.
- Whilst seabass fishers claim that their monopoly over seabass fishing would restore the stock levels and boost the local economies, commercial fishers flag the importance of seabass fishing for their livelihoods as well as national food security.
- There are also lively debates within the two sectors as to who should be permitted to fish for seabass: critical seabass levels in the past led to a set of emergency measures on seabass licensing for commercial fisheries set out in the Council regulations (EU) 2017/127 of 20 January 2017. This regulation meant that seabass track records during a qualifying period determined whether a vessel, rather than an individual fisher, would get a licence or not.
- Five years on, the impacts of the licensing regime are reflected in a number of ways; whilst some commercial fishers are content with the system which enabled them to obtain a government fishing licence for free, others feel that they were left out and are struggling to buy a boat with increasingly more expensive authorisations.
- Some other issues connected to licensing revolve around the issue of licence transfers, authorisations for multiple gear types on the same vessel and the issues of access for new entrants to the fishing industry. At the same time, scientists and environmental organisations continue to emphasise the importance of ensuring that any licensing changes do not affect seabass stock levels.
- Fishers with seabass authorisations are broadly content with their current situation.
- Recreational fishers have become an increasingly important stakeholder group in conversations about the future of seabass fishing. However, their impact on seabass fisheries is difficult to measure due to the lack of clarity around the numbers of recreational anglers and their fishing activities.
- One idea to gain a better understanding of the sector was to introduce recreational seabass licences. Whilst popular with the commercial sector, this measure was not fully embraced by recreational fishers. However, recreational support was greater when discussing the prospect of investing the funds directly into supporting the recreational sector, enforcement, conservation and science.

Risks

- Many stakeholder groups are struggling to see the benefits of other stakeholder groups, and the divide between the recreational and commercial sectors in particular, is making any decision on the partitioning of the sector controversial.
- Many stakeholders also agree that it is difficult to define and measure benefits, with financial aspects being only one of many indicators.
- In terms of commercial licences, a number of commercial stakeholders flagged that the current system is unfair and confusing; the authorisations system, which was brought in as an emergency measure when stocks were depleted, is not working anymore.
- Some feel that the licence allocation was unfair and that it has created a highly competitive and expensive licensing market. Many participants emphasised that any changes in the current licensing regime need to take account of the limited seabass stocks.
- Some stakeholders spoke about an unfair disadvantage for young entrants into the fishing industry.
- Some commercial fishers said that the lack of flexibility with licence transfers is not sustainable and that those rules should be relaxed, particularly as upgrading the boat often means that the vessel will be safer to use.
- Many commercial stakeholders flagged the lack of need for recreational seabass fishing, despite them being able to take fish out of the sea.

"The seabass stock is slowly growing but it's time to move away from emergency measures. We have a society asset which has been given property rights to those with track records. The policy has pushed up the price of boats which means young people can't buy their way into the fishery. It's an asset which belongs to society."

Recreational fisher, via co-design workshop

"The elephant in the room is the fact that some people were given authorisations at one time, and others have had to pay. The agreement is that the biggest mistake in this fishery was letting some people have free authorisations and others have to pay. Government should buy them all back and then re-issue them."

Commercial rod and line fisher, via co-design workshop

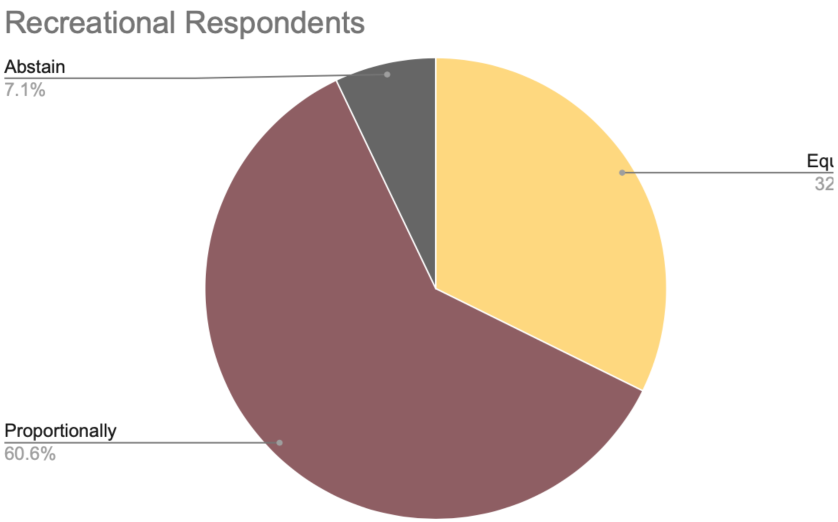
Opportunities

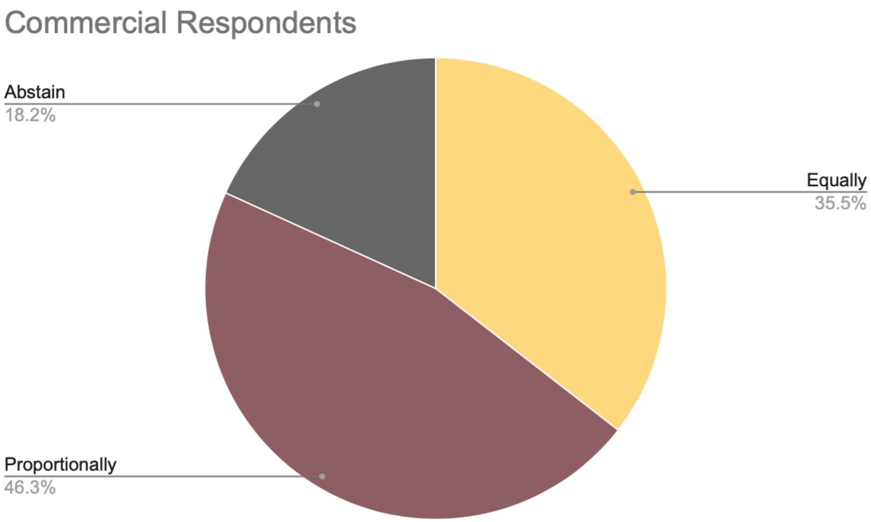
- Some stakeholders recognised that the recreational and commercial fisheries operate very differently, hence there is space for both of them to coexist and generate positive benefit.
- A number of recreational fishers emphasised that recreational seabass fishing activities do not impact the stock levels, hence their access to seabass fishing has little negative impact on seabass stocks.
- Many participants, particularly from environmental agencies and the recreational sector, support a capped licensing system, which can help seabass flourish as a species.
- According to some stakeholders, the revamped licensing regime could have a potential to make seabass fisheries more sustainable by prioritising licences for smaller vessels who fish in a sustainable manner.
- On recreational fishing, revenue raised from recreational seabass licences could be used to fund the recreational sector and/or scientific research and enforcement activities, thus contributing to a thriving recreational sector.
- Freshwater angling already operates on a paid licence system, and introducing a similar regime for sea angling would follow a familiar precedent.
- Recreational licences would enable the recreational sector to have a better overview of the numbers of fishers, their profiles and fishing patterns, which could give them a leverage in any future stakeholder discussions on seabass fishing.
- Some participants believe that recreational seabass licences would create more of a level playing field between the recreational and commercial sectors.

Recommendation 4.1

Quick win

- **Ensure access to fishing opportunities is balanced between recreational and commercial fishers in proportion to the benefit they generate.** This recommendation acknowledges that different sectors generate positive benefits.
- The majority of respondents, 47.9%, favoured this approach. However, in the comments it was evident that there are different definitions of ‘the benefit’ ranging from financial benefits and taxes paid by commercial fishers to the wellbeing benefits of sport seabass angling.





More than 60% of recreational respondents (60.6%) support prioritising partitioning access in proportion to the generated benefit in comparison to less than half of commercial fishers (46.3%).

Roughly one third of both commercial (35.5%) and recreational (32.3%) respondents support an equal split.

Recommendation 4.1

Quick win

Next Steps

- It is important to use future stakeholder engagement opportunities, including the upcoming public consultation, to further unpack the definition of 'benefits'. Some options that have been identified in the co-refine survey included: direct and indirect economic benefits to individuals, local communities and the national economy; environmental benefits; psychological welfare; social benefits for coastal communities.
- Most of the listed benefits are not mutually exclusive and it has become evident that different stakeholder groups generate different positive benefits. Further stakeholder engagement should focus on reiterating this message and work towards recognising the possibility of partitioning fishing opportunities between the two sectors without needing to make any major compromises.

"To me the benefits are the opportunity to meet fundamental needs. I am not against recreational anglers targeting seabass, but against retention. The joy in angling is primarily the catching, not the retaining. The need to retain is far less. Benefit therefore needs defining to reflect the level of absolute need for each group."

Co-refine survey respondent

"Benefit should be measured holistically including benefit to the regeneration of stocks and the local marine eco systems, the coastal communities ad their businesses, the health including mental health of those involved, and the overall revenue generated by the sector."

Co-refine survey respondent

Recommendation 4.2

Quick win

- **Maintain the existing seabass authorisation system and reference period while the seabass stock fully recovers, but actively explore alternative approaches within a specified timeframe following publication of the FMP.**
- Addressing the challenge of the future seabass licensing regime was one of the most difficult ones in co-design workshops, six out of nine groups abstained from choosing between the four priorities that were on offer.
- In the survey, one third of respondents (33.5%) - the highest proportion - voted for maintaining the current licensing regime as their priority.

Recommendation 4.2

Quick win

Next steps

- Evaluate this recommendation in light of scientific stock level assessments. It is clear that any future changes to the licensing regime and a policy decision on whether or not emergency measures are still needed are contingent on the scientific stock level assessments, given that stakeholders' views on this subject are divergent.
- Ensure that scientific assessment is communicated to the fishing community in the name of transparency and openness.

System wide change

- Explore regulatory opportunities that could benefit from further improvement. Some ideas that could be explored in the public consultation include:
  - The ability to upgrade vessels (to a bigger one) on the grounds of safety;
  - Reconsidering dual authorisation for different types of gear;
  - Consider introducing incentives for new entrants, in particular youngsters, to enter the profession;
  - Consider the reintroduction of certain types of gear types in specific local areas.

These suggestions should be explored further in the consultation and, in particular, following the publication of the FMP in 2023.

"I like the idea of maintaining the current capped system for those with existing seabass authorisations only. We've got a manageable number to start with, which means relative stability is applied to the seabass fishery. Effort is capped."

Environmental NGO, via co-design workshop, Wales

"The priority [with licensing] should be phasing out damaging gear types and then prioritising rod and line seabass licences for small, sustainable catches."

A recreational fishing organisation representative, via co-design workshop

Recommendation 4.3

Quick win

- **Keep seabass accessible, with no licence to catch recreationally (within agreed bag limits), but with the potential to consider a national licence for recreational sea angling as stocks recover in future.**
- Co-design workshop groups were split on this question, however four out of nine opted for maintaining the status quo as their collective consensus.
- In the survey, more than half of all respondents (52.4%) said that their preference would be to maintain the current system of not needing a licence for recreational sea angling. The preference for seabass fishing recreationally without a licence was greater amongst recreational fishers (76.2% versus 33% of commercial fishers).

Recommendation 4.3

Quick win

Next steps

- Maintain the status quo and allow recreational fishers to fish without a seabass licence.

System wide change

- Stakeholders acknowledged the difficulties of introducing a single seabass licence; hence, any future regulation could explore the potential of introducing a wider licence for sea angling.
- Stakeholders also talked about the problems of enforcing recreational licences. If such a licence was introduced, enforcement bodies would need a suitable strategy and additional resource to monitor it and enforce it where needed.
- Funding was a major issue; should a seabass recreational licence be introduced; it would be worth exploring how the money could be used for either additional enforcement or conservational efforts.

"I would have no problem paying for a licence if it was invested sensibly. [...] I don't mind paying if it helps the seabass stocks, if money goes towards science or enforcement - as long as it was a sensible price."

Recreational fisher, co-design workshop in Milford Haven

"Unfortunately, Government doesn't seem to appreciate the voice of anglers, even though the economic benefit from angling far exceeds that of commercial harvesting. A licence fee will give anglers a voice, which they will use and which Government will no longer be able to ignore."

Recreational fisher, survey, South West England

5. Fishery management strategy and monitoring

The future FMP can only be successful if the provisions which they entail are implemented and enforced properly. Stakeholders across the seabass system agree that the current system requires an overhaul

This section covers stakeholders' views on:

- How seabass regulation should be enforced;
- Whether or not seabass should be managed at a national or regional level;
- The best ways of working together on reviewing and revisiting the seabass FMP in future.

The recommendations in this section are for the rules to be simplified and communicated more clearly in order to increase compliance. We also recommend maintaining the current system, whereby the rules are applied nationally with some flexibility for regional variations. Lastly, we also recommend that the FMP adopts adaptive approaches where fishers, scientists and policy makers come together to identify priorities and strategies for monitoring and assessment, responding to new opportunities and updating the FMP in the context of ICES advice.

Insights

- Complex and confusing regulation is one of the key challenges mentioned by the vast majority of stakeholders.
- One stakeholder gave us an example of when they were struggling to grasp the regulations and were subsequently fined. Many worry that the new seabass FMP will add another layer of complexity leading to more challenges for fishers.
- Some stakeholders mentioned rules and regulations that are not fit for purpose; contradict one another; are ambiguous; or out of date. Some of the examples that were mentioned include the lack of clear definition of 'unavoidable by-catch' and the misalignment between the rules on mesh sizes and the seabass size regulation.
- Most stakeholders agree that the existing enforcement system is under-resourced and inefficient, with the relationship between different enforcement bodies often being unclear and fractured. This enables the circumvention of rules and illegal fishing practices.
- Some stakeholders flagged that it would be important to efficiently enforce the existing rules before starting to add additional rules and regulations.

Risks

- Rules and regulations are challenging to understand and there is a risk that the complexity leads to lower compliance.
- National rules risk ignoring specific local contexts, thus making some areas (such as the East of England) disadvantageous.
- Working in silos and without close collaboration between different stakeholder groups risks making regulation unfit for some stakeholder groups.

Opportunities

- Simplifying regulation by providing clear and precise definitions would make fishers' day-to-day jobs easier.
- Where simplification is not possible, increased and more effective communication has a potential to make compliance more effective.
- National rules can simplify seabass regulations and ensure that local regulations don't overwhelm fishers and other stakeholders with unnecessary complexity.
- Proactive and reactive revision of rules can ensure that the regulation is not outdated, unclear, damaging or otherwise unfit for purpose.
- Working collaboratively across stakeholder groups can ensure that the regulation works for all stakeholders.

Recommendation 5.1

Quick win

- **Simplify regulations to improve compliance and enforcement and increase efficiency, where possible and when appropriate. This is with the caveat that regulations should also be clearly communicated and easily accessible to all.**
- Six out of nine co-design workshop groups voted for the option of simplifying regulation as their favourite potential solution, making this approach the most popular one. Similarly, this approach was favoured by the most survey respondents with 44.2% opting to vote for this solution.

Recommendation 5.1

Quick win

Next steps

- It is important to use future stakeholder engagement, including the public consultation, to further refine areas where clearer and simplified regulation is needed (e.g. 'unavoidable by-catch').
- Where it is not possible to simplify the rules because of the complexity of a certain policy/enforcement area, a targeted communication campaign is needed. Email engagement, social media, posters and representative organisations can help disseminate key information. It is important that it is explained clearly and in simple language, so that everyone can understand it.
- Fishers are also calling for more approachable enforcement bodies, potentially by introducing community liaison officers, who could help stakeholders understand and apply the regulation.

"Regulators often do not understand as well as fishers. As someone whose job it is to enforce the regulations, I have to admit even I'm struggling to understand them now, it's getting so complicated."

Enforcement officer, via co-design survey

"Create a single simple website source for all regulations within the UK. Currently it's pot luck on whether you find the most current regulations on fishing for a specific area. [...] The summary is key as often the detail just leaves one confused. Especially if one finds another website with similar information put a different way."

Co-design survey respondent

Recommendation 5.2

Quick win

- **Prioritising a mostly national, somewhat regional, plan so all seabass rules apply throughout England and Wales, however authorities could make relevant regional byelaws (similar to the current system) to reflect local differences.**
- Four out of nine groups in co-design workshops collectively voted in favour of a mostly national and somewhat regional plan, making this option the most popular potential solution across all nine workshops.
- In the co-design survey, 42.3% of survey respondents voted in favour of a fully national plan, whilst a quarter of respondents (25.1%) opted for a mostly national, somewhat regional plan.

Recommendation 5.2

Quick win

Next steps

- Maintain the status quo in England and Wales

System wide change

- Moving forward, further research is needed to explore potential support and regulatory flexibility for fishers working in the areas with less diverse fisheries, given that some stakeholders pointed out that fishing opportunities vary greatly according to the region or specific locality.

"Virtually all rules should apply to England and Wales, to avoid confusion and improve compliance. There may be a need for some regional variations for example, in the North Sea where seabass spawn later."

Co-refine survey respondent

"Most rules should apply for all in England and Wales, since: 1) seabass are migratory and move around our coasts at certain times of the year; 2) different rules from one district to another cause confusion and lower the rate of compliance."

Co-refine survey respondent

Recommendation 5.3

Quick win

- **Prioritise adaptive approaches being developed where fishers, scientists and policy makers come together to identify priorities and strategies for monitoring and assessment, responding to new opportunities and updating the FMP in the context of ICES advice.**
- All nine co-design workshop groups' consensus were in favour of adaptive approaches, thus making this option a firm winning solution. Similarly, this option was popular with survey respondents. 58.1% of those surveyed favoured this approach as their priority.

Recommendation 5.3

Quick win

Next steps

- Use the public consultation to explore the best arrangements for conducting meetings. Many stakeholders are calling for meetings to be held online, allowing wide participation from across England and Wales, as well as a clear record of the meeting.
- Further consideration needs to be given to who is invited to such meetings. In our experience, any engagement opportunities attracted a high number of stakeholders, so it is important to consider limiting the number of invitees in order to make the meetings more productive.
- Further reflection is needed on the frequency of such meetings. Meetings once a quarter, twice a year or once annually have been suggested by stakeholders.
- It is paramount that meetings are chaired by an independent chair who will listen to, facilitate and acknowledge differing views.

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Final reflections and next steps

Policy Lab's study is the result of extensive research, bringing together varying voices from across the seabass landscape. Throughout the project Policy Lab used a number of methodologies to engage stakeholders and invite participation. Adopting a mixed methods approach also meant that each phase of the project informed the next phase in an iterative and collaborative co-design process, and that qualitative and quantitative insights complemented each other towards the production of a solid evidence base.

The collaborative nature of the process, based on bringing stakeholders together, invited negotiation and collaboration and provided participants with the opportunity to understand the bigger picture. Maintaining and reinforcing a close working relationship across an often fragmented and divided seabass landscape is essential for the continued progress and success in designing any future seabass regulation.

Defra and Welsh Government will take Policy Lab's work forward into a draft final seabass FMP. This will be followed by public consultation in summer 2023 and then final publication of the new seabass FMP in December 2023.

Research Limitations

It is necessary to recognise the research limitations, these are outlined over the next slides.

Policy Lab's study is the result of extensive research, bringing together varying voices from across the seabass landscape. Policy Lab used varying methods to engage stakeholders and invite participation. The number of participants engaged was large, but it is important to recognise that not all views and opinions will have been heard and that the sample size therefore contains bias.

Policy Lab visited seabass locations across England and Wales. It is necessary to point out that Policy Lab had limited time and resources when carrying out the lived experience research and co-design in-person workshops and therefore could not visit all seabass locations across England and Wales. The locations visited were decided in collaboration with Defra, the Welsh Government and the wider seabass ALB group. It should be noted that Policy Lab offered many online opportunities to engage in the seabass project to ensure all stakeholders, no matter where they lived, could take part in the research.

Research Limitations

The Collective Intelligence (CI) online debate asked stakeholders to vote on statements and add their own statements. It is important to be aware of the systems limitations, for example, it is not clear from the CI data the reasons why a participant decided to pass on a statement or the strength of agreement or disagreement. It is also possible for different participants to interpret the same statement in different ways. However, the binary choice is also a strength of the CI process as it encourages decisive voting and the number of unique statements submitted by participants can be extensive.

Policy Lab aimed to listen to as many voices as possible from stakeholders across the seabass landscape. Throughout the project, any imbalance between stakeholders had to be managed and mitigated carefully to ensure the process was as balanced as possible.

Top takeaways

Providing seabass stakeholders with a wide range of participatory methodologies, both online and in-person, to engage with Policy Lab invited them to participate in a manner that they were the most comfortable and available for. For example, some stakeholders took part in two-hour, face-to-face co-design workshops, whilst others were able to fill in a survey or send an email to a dedicated email address, within minutes.

Each phase of the project informed the next stage in an iterative and collaborative co-design process. Emerging themes from the lived experience research were the basis for the initial Policy Lab statements for the CI debate. The CI debate enabled stakeholders to create their own statements that were voted upon and subsequently led the co-design phase. Priorities from the co-design phase were then tested in the co-refine survey. With each iteration providing the starting point for the next, this approach ensured that every phase of the project was co-designed and co-refined by stakeholders.

Top takeaways

Working in small, mixed groups in the co-design workshop phase provided participants with the opportunity to understand the bigger picture. Recreational, commercial, charter boat, buyers/sellers, scientists, enforcement and environmental NGOs sat around the table, or collaborated online, working together to prioritise FMP solutions. Supported by a specially designed serious gaming framework, stakeholders listened to each other's views and opinions. The process invited negotiation and collaboration, as participants discussed the current seabass landscape and future FMP ideas. This approach impacted on the preferences we heard in workshops versus the surveys (which were not deliberative) and whilst more research is needed, this approach indicates that deliberative dialogue does build trust and empathy between stakeholders and government and supports consensus building.

This collaborative mixed methods approach allowed qualitative and quantitative insights to complement each other towards the production of a solid evidence base to support the next steps of the new seabass FMP.

Next steps

Defra and Welsh Government will take Policy Lab's work forward into a draft final seabass FMP, informed by:

- Policy Lab recommendations
- FMP evidence statement and Bournemouth University, Cefas, IFCAs, Seafish, MMO
- Conservation advice: JNCC/Natural England

This will be followed by Public consultation in summer 2023 and then final publication of the new seabass FMP in December 2023.

All stakeholder correspondence for the seabass FMP should be addressed to: bassFMP@defra.gov.uk

Annex: Fisheries Act objectives

The FMP will ensure that the fishing and management strategies have clear links to the objectives, laid out in the Fisheries Act. These are:

- **Sustainability objective**: There is a requirement that fisheries are environmental, economically and socially sustainable;
- **Precautionary objective**: There should be a 'precautionary approach' applied, ensuring stocks are harvested sustainably, and in a way that restores and maintains populations;
- **Ecosystem objective**: There is a requirement that an ecosystem-based approach to management is used, and bycatch of sensitive species is minimised and, where possible, eliminated;
- **Scientific evidence objective**: There is a requirement that data is collected, and shared between authorities, and the best scientific advice is used to develop management measures;
- **Bycatch objective**: Bycatch of undersized fish should be minimised and avoided, catches should be recorded and accounted for, and bycatch of commercial species should be landed - but only in a way that ensures there aren't incentives to catch undersized fish;
- **Equal access objective**: Ensuring that UK fishing boats have access to fish in all UK waters.
- **National benefit objective**: Ensuring that the fishing activities of UK boats bring economic and social benefits to UK communities.
- **Climate change objective**: There is a requirement that the impacts of fisheries on climate change is reduced, and that fisheries are able to adapt to climate change.

POLICY LAB

Department for Environment Food & Rural Affairs

December 2022

Lived Experience Research: A Summary

Sea bass fisheries management plan 2023

Project team

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POLICY LAB
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Overview

The following report is a summary of the lived experience research phase of Policy Lab's engagement work for the new bass fisheries management plan (FMP), which took place in July and August 2022. It was commissioned by the Department for Environment Food and Rural Affairs (DEFRA).

This research provides insights about bass stakeholders' lived experience of the sector, their views and perceptions of the existing bass management as well as their hopes and fears for the new bass FMP.

Stakeholders are spokespeople only for their own lives. They do not represent the full breadth of experiences of the bass sector.

This research focuses on diverse findings, nuances, and richness, rather than general patterns. The findings should therefore be considered alongside other types of evidence.

This insight should invite consideration of how local and central government policy is experienced in everyday settings.

We hope that the insights gathered will help decision makers to better understand the areas of challenge, as well as support new ideas and dialogue on how to improve the bass fishery management.

About Policy Lab

Policy Lab is a multidisciplinary team working openly and collaboratively across government, bringing expertise in policy, ethnography, systems thinking, futures and design.

We support the public sector to achieve better policy outcomes by partnering on innovative projects, leading and demonstrating best practice, and delivering training.

Since 2014, we have partnered with policy teams on over 170 projects, working with 7,000 public servants across central and local government departments and agencies, as well as internationally.

Policy Lab is a multi-award winning, and one of the world's longest-standing government Labs dedicated to policy innovation.

Our projects test new approaches which bring lived experience and experimentation into policymaking. We share our new tools and techniques openly on our blog and the Open Policy Making Toolkit to encourage system-wide transformation.

Project Timeline

Evidence Discovery and Expert Interviews (April - May '22)

Lived Experience Research
(June - August '22)

Combination of pop up and ethnography research to gain deeper insights.

Collective Intelligence Debate (August '22)

Co-Design (September - November '22)

Co-Refine (November - December '22)

Locations and Stakeholders

- We engaged with around 90 stakeholders across England and Wales including:
  - recreational fishers
  - commercial fishers
  - sellers of bass
  - Marine Management Organisation (MMO)
  - Inshore Fisheries & Conservation Authority (IFCA)
  - charter boat skippers
  - tackle shop owner

Methodology

Policy Lab's lived experience research visits entailed two different methodological approaches described below:

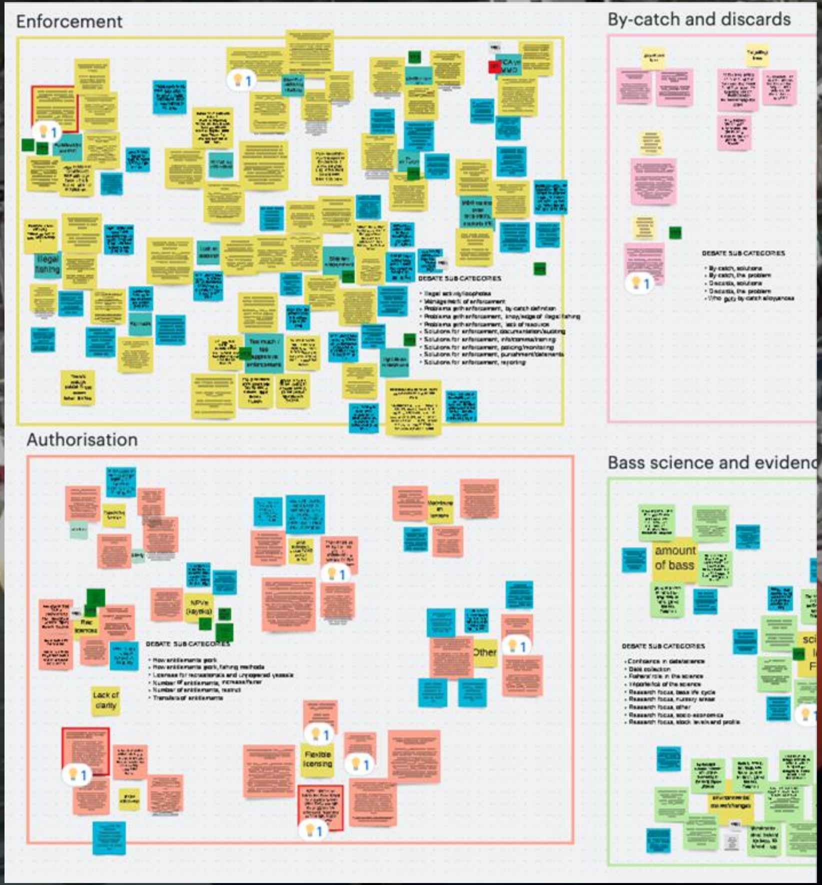
Ethnographic Research

In-depth social research method to illuminate the perspectives and experiences of fishers and other bass stakeholders

- Selecting stakeholders against a set of different criteria (location; type of fishing; type of gear; length of experience etc)
- Recruiting stakeholders via an online form and cold calling
- Spending at least three hours with each stakeholder
- A mixture of observations, filmed lived-experience & informal interviews

Pop-up Research

- Gathering a range of insights from diverse stakeholders in order to understand the big picture
- Speaking to a wide range of people with direct and indirect connection to bass
- A mixture of pre-arranged and ad hoc informal conversations with fishers, representatives of enforcement agencies, bass sellers and other bass stakeholders



Screenshot of the LucidSpark board group analysis.

Analysis and Reporting

To turn the raw data we collected from our visits into research insights, we analysed audio recordings, videos and fieldwork notes, and clustered insights into broad overarching themes, using collaborative online software LucidSpark.

Researchers used LucidSpark to further refine our analysis and define specific sub-themes, following a set of steps:

- Individual analysis per trip and research activity
- Group analysis to refine initial theme clusters and group insights into sub-themes
- Playback session with the Department for Environment, Food & Rural Affairs (DEFRA) and the Centre for Environment, Fisheries and Aquaculture Science (CEFAS)
- Refining themes and categories
- Report writing

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Themes

- Bass regulation
- Enforcing the rules
- Bycatch and discards
- Authorisations and licences
- Bass science and evidence gathering
- Local approaches
- Engagement and relationships
- Hopes and fears for the future

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Bass Regulation

This theme covers the perceptions of the existing regulations on bass fishing.

Whilst most stakeholders acknowledge that a strong regulatory regime is important in preserving the bass stock, not all agree on the best approach to regulate bass fishing.

Fishers as well as enforcement officers told us that the current regulations are too complex, which can result in confusion and breaking some rules without realising.

Many commercial fishers also mentioned the impact of ever-changing regulations on their day-to-day work. This ranges from the impact on their personal safety (e.g. banning allegedly safer fishing equipment) to finances (for example, needing to purchase new equipment).

"The stocks are OK at the moment. They are in a period of recovery but I would say very very early days to relax anything. In my view it should never be totally relaxed."

Marine Management Officer (MMO)

Improving bass Stock Levels

- Most stakeholders agree that the past 'free-for-all' approach with no regulation in place for bass fishing had a highly detrimental impact on bass stock. They don't wish to go back to non-regulated bass fisheries.
- According to the vast majority of stakeholders, the emergency measures for bass fishing have successfully promoted bass stock across England and Wales. However, some recreational fishers disagree and believe that the current bass stock continues to be too low.
- Commercial fishers in particular consider bass stock is now at the level where some rules and emergency measures could be relaxed in favour of less regulated commercial fisheries.
- We have also heard that, although not entirely successful, the existing bass regulation has played an important role in limiting and preventing illegal bass fishing.

"Get the regulations up to date, some are 20 years old."

Commercial fisher, Barrow-in-Furness

Navigating Complex Regulations

- Complex and confusing regulation is one of the key challenges mentioned by a vast majority of stakeholders.
- One stakeholder gave us an example of when they were struggling to grasp the regulations and were subsequently fined. Many worry that the new bass FMP will add another layer of complexity leading to more challenges for fishers.
- Most stakeholders are calling for the new regulation to be easier to understand and to abide by. They would also like the regulation to be more flexible and proactive rather than punitive, taking into account specific local contexts and real-time needs.
- Some stakeholders mentioned rules and regulations that are not fit for purpose; contradict one another; are ambiguous; or out of date. Some of the examples that were mentioned include the lack of clear definition of 'unavoidable bycatch' and the misalignment between the rules on mesh sizes and the bass size regulation.

The Impact of Regulatory Changes

- We were told that the ever-changing regulation can impact fishers in their day-to-day activities.
- Some commercial fisheries mentioned the financial impact of regulatory changes; for example when the new mesh size regulation came in, commercial netters had to purchase new nets, without being compensated for the financial loss.
- Some commercial fishers also talked about the impact of the changing regulations on their safety. For example, the change in bass entitlements means that fishers who want to upgrade their vessels to a bigger and safer one, cannot do that without losing their entitlements. Others mentioned the safety implications of banning drift netting in estuary environments, which are allegedly dangerous and inappropriate for static nets.

"The only reason why I'm having a bigger boat is for safety reasons [...] and now I'm being penalised [because of ongoing problems with not being able to transfer bass licence]."

Commercial fisher, Poole

"Mesh sizes, for example, you never get compensated, you just throw away the gear. It happens overnight, it's not a 12 month thing for example."

Commercial fisher, Barrow-in-Furness

> ***"Bass don't mature until 45cm and yet the take limit is 42cm. You are taking out fish before they had a chance to spawn."***
>
> Recreational fisher, Pembrokeshire

Controversial Regulatory Areas 1/3

Some regulatory areas that were mentioned most commonly throughout the lived experience research:

Closed Seasons

- Whilst most agree that the current closed season approach supports the bass stock, there are some disagreements on the current duration and time of the year.

- Some stakeholders would like to see a local approach to closed seasons and real-time closures, as the one size fits all approach cannot necessarily work across the country.

Bass Size

- The current minimum landing bass size is 42cm. A number of recreational fishers would like to see the minimum size of bass increase, for example to 45cm, to support the bass life cycle.

- Most commercial fishers claim that the current size aligns with the bass life cycle and with the demands of the market i.e. a plate-size bass .

Controversial regulatory areas 2/3

> ***"I'd love to be able to fish forty fish and fill my freezer."***
> Recreational fisher, Barrow-in-Furness

Quota Approach

- Many commercial fishers we met consider that a quota approach (e.g. allowed set quantity of bass per year) would be preferable to current by-catch approach (allowed set yearly quantity of bass caught inadvertently as part of fishing for other species).
- Some would like to see a quota approach for the under 10-metre fleets in particular because their scale of operations is small in comparison to bigger vessels (current by-catch regulation is per type of gear not boat).
- Recreational fishers' opinions on the current bag limit vary. Some would like to be able to keep more than two bass per day (the current regulation), whilst other would like to see it reduced to only one or none to preserve the bass stock.

Drift Netting

- Drift netting is currently banned for bass fishing, however some commercial fishers and some MMO we spoke to consider that drift netting should be allowed in areas where they claimed it to be safer than other forms of netting, for example in estuaries.
- In light of drift netting being allowed for some other species and the nature of the sea bed in estuaries (for example, sand), fishers in support of overturning the ban believe that there would be little impact on the environment.

Bass Regulation Quotes

Fixed quota allocations - those could be created for bass.

Commercial fisher, Newlyn

You've got to look at legitimate fisheries you can use for drift netting and regulate the size of the mesh.

MMO officer

Controversial regulatory areas 3/3

"You get a cold winter it wipes out the young bass in the estuaries. This is something that should relate to regional regulations."

Recreational fisher, Pembrokeshire

Gear

- Many commercial fishers would like to be able to carry more than one type of gears per trip, which is not allowed under current regulation.
- Some feel that current bass regulations favour certain types of gear over others. For example, some commercial fishers find it unfair that trawlers have a bass percentage allowance and a bycatch limit, whilst netters only have a bycatch limit.
- Some recreational and commercial fishers would like to see netting and trawling banned altogether to preserve the bass stock and the environment.

Taking into Account Regional Differences

- The current regulation is national, with some discretion for specific regional byelaws, which for many commercial fishers add an additional layer of complexity to regulations that are already complicated. Nevertheless, most stakeholders agree that a regional approach is needed for certain regulations that cannot be covered nationally.
- For example, according to stakeholders, the spawning of bass is not the same everywhere and as such closed season regulations should be regional.

Enforcing the Rules

This theme covers stakeholders' perceptions of the enforcement of bass regulation by the Inshore Fisheries & Conservation Authority (IFCA) and the Marine Management Organisation (MMO).

Most stakeholders agree that the existing enforcement system is under-resourced and inefficient, with a relationship between different enforcement bodies often being unclear and fractured. This enables the circumventions of rules and illegal fishing practices.

At the same time, many fishers believe that the onus of enforcement is increasingly shifting onto fishers themselves; they have to complete and return various catch reports and are now also being asked to track their fishing activities using monitoring systems on their vessels.

Many stakeholders are calling for proactive and preventative approaches to enforcement that foster positive relationships between fishers and officers, and prevent unnecessary escalation of problems.

Inefficient Enforcement

- Most stakeholders agree that the existing enforcement system is under-resourced and inefficient, with a relationship between different enforcement bodies often being unclear and fractured. This enables the circumventions of rules and illegal fishing practices.
- Some stakeholders flagged that it would be important to efficiently enforce the existing rules before starting to add additional rules and regulations.
- Some commercial fishers complained about the existing way to record their catch as this mandatory process leads to a lot of duplication (for example, same information required both by MMO and IFCA) and the digital platforms are not user-friendly. This means that it is easy to mistakenly report the wrong data or fail to submit the report on time.
- However, there are divergences of opinions regarding the appropriate level of enforcement, with some fishers finding current enforcement too strict (for example, trackers on boats) whilst others claiming it is too weak and is lacking teeth.

"There's a lot of people who are catching with nets and registering it as caught with rod and line and nobody is monitoring this."

Commercial fisher, Poole

"If people see a problem with illegal fishing and report it - you can record a message, which will be listened to in the morning and of course by then the deed is done."

Recreational fisher, Newlyn

> ***"A good analogy [for MMO/IFCA] is a bit like the old days when you had traffic wardens and the police. There was always this crossover [...] What powers did the traffic wardens have? What powers did the police have? It almost is like we're the police and the IFCAs are traffic wardens."***
>
> MMO officer

Enforcement Bodies

- Most fishers said that IFCA and MMO currently do not work well together for the local enforcement and management of the fisheries, as there is a lot of overlap and unclear division of work.
- One MMO officer told us that the current division of marine zones is not efficient for the management of the fisheries, as they don't align (MMO uses a different geographical split to IFCA), which causes frequent problems.
- Fishers and enforcement officers alike reported unclear division between IFCA and MMO's responsibilities. This often results in the duplication of work, for example, when filling in catch returns. Fishers are calling for more effective sharing of intelligence.
- Some stakeholders said that local byelaws, introduced by IFCA on top of national regulation, add layers of complexity, which they find are already difficult to engage with.
- Some stakeholders said that IFCA and MMO should merge to simplify and streamline the management, regulations and enforcement related to the bass fishery.
- We heard of some positive examples of cooperation between the two bodies; for example, on the East Coast IFCA and MMO completed joined patrols by sharing resource, intelligence and authorities.

"There should be regional marine management officers like in the old days so then they get to know what's going on. It's personal, it's regional. They get to know the fishers."

Commercial fisher, Poole

Proactive Enforcement

- Some commercial fishers reported poor relationships with enforcement bodies. They are calling for more proactive and positive relationship, based upon cooperation and mutual trust.
- Many fishers highlighted the educational and supporting role of enforcement officers in helping fishers navigate the complex regulation.
- Proactive enforcement could lead to the reduction of offences, according to some stakeholders. Having direct and accessible local points of contact could help fishers tackle any arising problems.
  We heard numerous stories about proactive enforcement in action. For example, one fisher in the North West talked about MMO's outstanding support with administrative work, whilst another commercial fisher in the South East talked about receiving help with his licence application.

> ***"As far as I can see there's hardly, if any, rule enforcement for anglers. They're basically untouched."***
> Commercial fisher, Newlyn

Levelling The Playing Field

- Some stakeholders feel that the level of enforcement is not equally vigorous across the board, with some stakeholder groups being less scrutinised than others.
- In particular,, commercial fishers (as well as some enforcement officers) believe that recreational bass fishing is subjected to little or no enforcement.
- Many fishers and regulators alike also report the lack of enforcement of buyers and sellers of bass, which leads to illegal bass to be sold to markets, pubs and restaurants.
- We also heard the reports of foreign boats fishing illegally in British waters with little repercussion, which is creating unfair conditions for English and Welsh bass fishers who abide by the local laws and regulations.
- Many stakeholders are calling for stricter enforcement action in the sectors that are currently not subjected to enforcement designed to level the playing field. Introducing recreational bass licences or rolling out carcass tagging to ensure traceability of the fish from the boat to the plate have been mentioned as potential new measures to achieve this.

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Bycatch and Discards

Regulations on accidental capture of bass, i.e. bycatch, have been mentioned time and time again by stakeholders. Most complained that the current regulation in this area is unclear and regularly leads to unnecessary discards of fish. This means that there is a wastage of fish that could be used for food, whilst fishers face a loss of potential income.

However, stakeholders agree that bycatch is a challenging area and that it is difficult to get the regulation right. Some are calling for additional research and data to better understand the cause and effect of bycatch, while others hope for a quota-based approach for bass fishing.

Loose Definitions

Stakeholders across the board, from fishers to enforcement officers, agree that the current definition of unavoidable bycatch is too ambiguous to abide by and enforce.

Stakeholders also pointed out that bycatch doesn't work in mixed fisheries area where it is impossible to avoid catching bass whilst netting or trawling. To avoid confusion, some fishers are calling for bass to become a target species; this would depend on the bass stock and gear used for fishing for bass.

According to numerous stakeholders, the existing bycatch regulations have been too easy to exploit. In practice, it is often difficult to prove a difference between purposefully targeting bass and unavoidable bycatch.

We also heard that the current bycatch regulations inevitably leads to discards; fishers who are not allowed to land bass caught as bycatch, need to return the fish back to the sea. Some stakeholders said that all bass should be landed even as a give-away to charities to stop wasting food.

"Making black and white everything would be much much better than 'unavoidable bycatch' just say you're allowed to catch this and that."

Commercial fisher, Newlyn

"It's not Grimsby, it's a completely different scale here. You know what you're gonna catch, you can target [bass]."

Commercial fisher, Barrow-in-Furness

Bycatch and Discards Quote

"When they are dead, what a waste. If they're caught in a tremmel net that you're setting all night and a bass get caught in it then you throw them back dead [...]. It's not right."

Commercial fisher, Poole

"Keep the entitlement for the boats that have them but every boat under 10 metres should be allowed some form of bycatch."

Commercial fisher, Newlyn

Minimising Discards

- Some stakeholders emphasised the importance of improved data around bycatch and discards to help fully understand their impact on bass stock. Reporting discards as part of regular daily self-reporting was mentioned as one way of collating the data.
- Reducing the existing mesh size could prevent catching smaller bass. However, commercial netters highlighted that any further reduction of mesh size could also stop them catch other fish species, such as mullet.
- Some fishers are calling for a quota-based approach, as it following the regulatory precedent taken for some other species. One fisher said that an annual bass quota for trawlers, for example, would be easier to track and uphold than the current 5% limit.
- According to some commercial fishers, a small quota allocation of bass would also aid fishers without bass entitlement and under-10 metre vessels. This could ensure a fairer access to bass fishing and would support small, sustainable fishing businesses.

Authorisation and Licensing

This theme focuses on access to bass fishing for commercial and recreational fishers via authorisations and licensing.

Throughout the lived experience research, many commercial fishers reported mixed experiences with the current licensing regime and how it has impacted their fishing activities and, ultimately, their livelihoods.

Some commercial fishers reported the problems of obtaining bass authorisation due to increasingly high prices of vessels with bass entitlements. Others talked about the lack of flexibility for transferring entitlements to bigger - and safer - boats, thus forcing them to choose between safety and income. Some others discussed the problems of authorisation for a single gear type, which is making their fishing harder.

Whilst stakeholders generally agree that licensing is important to preserve bass stock levels, the question of who is authorised to fish for bass and what gear can they use remains highly disputed amongst the people we met.

Commercial Licensing Regime

- A vast majority of commercial fishers reported direct or indirect negative experience with the current licensing regime from 2017, which linked bass track records to boats instead of licensed fishers. This has had major financial impacts on those who lost out on entitlements and those who are trying to enter the industry.
- Some of the commercial fishers struggled to evidence their track records of bass fishing, which meant that they lost their bass licences and, at times, jobs. We heard about examples where fishers couldn't gather the evidence because they temporarily had to stop fishing for a long time because they were ill or had to take a second job to solve financial difficulties.
- Additionally, some stakeholders complained that this change of law has affected the boat market as bass licences have become prized commodities.
- Some fishers told us that the change in bass entitlements means that fishers who want to upgrade their vessel to a bigger and safer one, cannot do that without losing their entitlements.

"That's all he's done catching bass nothing else and he changed his boat [to a bigger one] and now he's out of a job. They took his entitlement it shouldn't have happened."

Commercial fisher, Newlyn

"I'm stuck with this boat now [...] Let's say I wanted to swap [current boat] to a catamaran, which is bigger hence making everything safer [...] I'd lose my bass entitlement because it doesn't belong to me, it doesn't belong to the licence, it belongs to the boat."

Commercial fisher, Poole

> ***"Fresh water bass fishing has a licence [...] Sea anglers could have one too."***
> Recreational fisher, Stoke Gifford

Recreational Licensing

- Some recreational fishers proposed the idea of recreational bass licences. According to these stakeholders, licensing would give them more of a voice with regards to bass management. The raised funds from the licences could contribute toward the recreational vision for bass such as better conservation.
- However, some recreational fishers feel that there should be no licence to fish bass as they perceive the sea to be a public resource and should as such remain accessible to all.
- Many commercial fishers supported the idea of recreational licences, mostly because they feel that the weight of regulation and enforcement is currently solely on their shoulders.
- Many fishers as well as enforcement officers flagged that a bigger issue than recreational licensing appears to be the lack of licences for 'non-powered vessels'. This loophole is allegedly exploited for illegal bass fishing across the country.

Bass Science and Evidence Gathering

This theme covers stakeholders' perceptions of science and evidence gathering. It also explores attitudes towards climate change and the role of fishers in science.

The stakeholders we interviewed have various levels of trust in science relating to bass as well as the role that scientific evidence plays in policymaking processes. Whilst stakeholders mostly support science-led approach to regulation, they do not always agree with the evidence-collecting methods and findings of government-backed scientists.

Mostly, fishers support greater collaboration between scientists and fishers to improve the quality and understanding of the data.

Trust in Science

- Most commercial and recreational fishers agree that the preservation of bass should be a top priority. As such, they support the new bass FMP to be science-led.
- However, stakeholders expressed different levels of trust in the existing scientific data collection and findings. For many commercial fishers in particular, the lack of trust comes from their own day-to-day observations, which allegedly don't always match the existing scientific data. This ranges from spawning seasons to stock levels.
- Commercial and recreational fishers expressed concerns about the science being manipulated for achieving policy objectives. Whilst some commercial fishers believed scientific data was skewed to work against the commercial sector, some recreational fishers believe that policymakers are ignoring scientific findings in favour of supporting the commercial sector.
- Some fishers, from the recreational sector particularly, have attempted to collect their own data and evidence.

"Nothing is based on science. Our current management plan doesn't take any of this into account."

Recreational fisher, Pembrokeshire

"Scientific assessment of bass needs to be done differently to avoid a cautionary approach. What we don't want is for the government to say to fishermen: 'so we've got the science and we've applied cautions so now you can't be catching [bass].'"

Seller of bass, Brighton

"The biggest scientists are the fishermen. Gain trust, get the fishermen to do the work. They know the areas."
Commercial fisher, West Mersea

Fishers' Role in Science

- Commercial fishers called for a closer collaboration between the fishing sector and scientists to produce better quality data and to develop a trusting relationship.
- Many fishers said that they consider themselves bass experts in their local marine areas, as they work on the ground every day. They would like to see their specific local knowledge to be used for scientific purposes.
- Many fishers are supportive of more collaborations between scientists and fishers .Those who have been previously involved in various scientific initiatives (both in a paid and voluntary capacity), reported highly positive experience. Many said that they enjoyed having scientists come aboard their boats and found it to be a mutually beneficial learning experience.
- We also heard from some MMO officers who said that collaborative bass science projects between the MMO, fishers and scientists could open new opportunities for building better relationships between those groups.

"I get along with CEFAS well because I think they are more hands on. I've got a camera with a microphone aboard the vessel [for them] for the last 18 months [unpaid programme]."

Commercial fisher, Newlyn

"[MMO collaborating with CEFAS] fitted very well with the job we were doing. [...] You could actually build up relationship between ourselves and the industry [...] because it was aside a bit from the enforcement side."

MMO officer

> ***"Global warming is going to make the bass stock stronger. You may even end up with stripped bass over here."***
> Commercial fisher, Brighton

The impacts of Climate Change

- Most stakeholders acknowledged the effect of the climate change on the bass stock over the past years.
- The most noticeable change that was mentioned by many stakeholders is the warming of the water. This has various impacts on the migration patterns, with bass now being increasingly more present in the northern parts of the country that were historically not associated with bass fishing. It also impacts the bass' diet, which calls for experimentation with new baits.
- Fishers also noticed changes in bass' spawning season; some stakeholders said that the current closed seasons, set out in government regulations, do not always align with the evolving situation on the ground.
- Whilst some worry that the climate change may have a negative impact on the bass stock, some commercial fishers told us that a warmer climate could see an improvement in stock levels in English and Welsh waters.

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Local Approaches

This theme refers to local approaches for the management of bass fisheries.

Many commercial stakeholders feel that their local areas have specificities that the bass fishery management needs to take into account, ranging from weather to bass stock.

Some commercial fishers and sellers of bass feel that the local economy around bass could be better supported to encourage the hospitality sector to buy local bass instead of importing it from other countries.

Most stakeholders think that the new bass FMP should consider regional differences to avoid imposing national regulations on areas where they are not needed.

> ***"We must have regional regulations. The Thames estuary is a completely different area for fishing– It needs its own policy."***
> Commercial fisher, West Mersea

Regional Variations

- Many stakeholders spoke about specific local issues, which vary from region to region or are specific for their local areas. They are calling for the new FMP to recognise regional differences and build them into the new plan.
- Stakeholders talked about numerous examples of what they perceive to be their local issues; these vary from the diversity of fish stock; diversity of other species (for example, seal population in Cornwall has been mentioned by numerous fishers as an increasingly visible problem); weather conditions; type of water and seabed; water temperature; and the prevalence of wind turbines.
- According to stakeholders, these local specificities do not only impact bass stock level but also the type of gear that is suitable for environments. For example, drift netting has been mentioned as favourable for estuary bass fishing by numerous commercial fishers. Other aspects of fishing, such as the timing of the closed season for bass are also impacted by local contexts (for example, regional climate).
- Many stakeholders support local initiatives that have a positive impact for their local areas, for example local bass nurseries that boost stock levels.

Supporting Local Fisheries

- Most stakeholders agree that the new bass FMP needs to better support local areas and their bass-related economy.
- Some sellers of bass and commercial fishers feel the government should introduce measures to encourage the local hospitality sector to buy local bass rather than import it from abroad.
- Fishers based in the North of England expressed their concerns over government neglecting them as stakeholders in favour of the more lucrative bass industry in the South. For instance, they report limited access to stakeholder meetings, poorer training and information-sharing provision and less developed infrastructure. Fishers in Barrow-in-Furness told us that they need to take a four-hour round trip in a car to access the only auction place in the region.
- One IFCA officer considers that a good start towards better local support would be to define the term 'regional' within the existing bass and fishing regulations, as the current use of the term lacks clarity.

"More time and money is invested in the South and South West, maybe it's because people dismiss us because it's only a few people fishing here."

Commercial fisher, Barrow-in-Furness

"We don't support local. We are not consistent with what we catch. Restaurants need supply. We need government support. The oyster bar down the road, they were buying skate from New-Zealand because it was cheaper."

Seller of bass, West Mersea

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Engagement and Relationships

This theme covers the stakeholders' perceptions of relationships within the bass system as well as the central government's engagement with stakeholders.

Stakeholders across the board agree that one of the key barriers to successful engagement and management of bass fisheries is the inability for a wide spectrum of diverse bass stakeholders to understand each other's point of view and work collaboratively to achieve common goals.

Furthermore, bass stakeholder report the general lack of trust in the government, which often renders the engagement meaningless. In addition, too many government-led stakeholders events cause an engagement fatigue, whilst organising the meetings at times that are inconvenient for fishers (for example, when the weather is good and during the time of day when most commercial fishers are out fishing) prevents a larger group of stakeholders to engage efficiently.

Stakeholder Tensions

> ***"We all need to sort of rally round, get round the same table and speak and talk to each other rather than pointing the finger. Let's get together and tackle it as one."***
> Recreational fisher, Seaton Carew

- Numerous stakeholders mentioned the animosity between different stakeholders' groups and the subsequent difficulty of bringing together diverse voices from across the bass system.
- Some commercial stakeholders pointed out differences and disagreements within their own sector; there are many different types of commercial fishers, which vary in terms of fishing gear, vessel size etc., hence it is difficult to speak with a single voice. For example, some rod and line commercial fishers said that they have more in common with recreational anglers than with trawlers.
- Some commercial fishers expressed their dissatisfaction with the recreational sector having a strong input into the shaping of regulations that impact the commercial fisheries.
- At the same time, some recreational fishers reported seeing biases coming from the management system, including the central government and enforcement bodies, towards commercial fishing at the detriment of bass stock levels.
- However, most stakeholders expressed interest and a will to work collaboratively across the sectors and groups to achieve a common goal. Some also mentioned ideas to help improve the relationships, for example by establishing a council, participating in co-design workshops or adopting a common code of conduct.

"The fishing industry is so disparate [...] We struggle to speak with one voice. The NFFO* tries but their membership is so diverse they can't get everybody to agree so they end up sitting on the fence too much."

Owner of a large fishing business, Brighton

**National Federation of Fishermen's Organisations*

"I feel like we are just a tick box. […] We're putting very detailed, very reasoned argument, putting a lot of time to have our say at that level and I feel it's ignored."

Seller of bass, Brighton

Public Engagement

- Most stakeholders declared their lack of trust in government, mentioning that they feel there's a lack of long-term vision coupled with an existing slow system meaning that by the time the regulations are effectively put in place they are not appropriate anymore.
- Most stakeholders we met also expressed their public engagement fatigue. They experience workshops and other engagement activities as tick-box exercises rather than a way for them to impact decision making. They wish for more direct bottom-up decision making instead.
- When stakeholders felt engagement formats are often too complicated and/or not appropriate (for example, timing of event, ability to make one's voice heard at the workshop).

Hopes and Fears for the Future

This theme refers to the stakeholders’ hopes and fears for the future of bass fishing.

Most stakeholders talked about their hope to achieve long-term resilience and thriving of the bass market, industry and local coastal communities that benefit from bass fishing activities. According to stakeholders, this is important for fishers’ personal livelihoods and mental health as well as for the survival of local coastal communities; it provides jobs to local residents, creates income from tourism and nurtures existing communities and heritage that revolve around fishing. fishing legacy and heritage.

Stakeholders also shared a number of fears for the future, pertaining to the bass fishing and local coastal communities more broadly. From shrinking of commercial ports to the pollution and increasing financial pressures, fishers are worried about what the future might hold for bass fisheries.

Maximising the Benefits of Bass Fishing

- Stakeholders' main hopes for the future relate to being able to continue fishing, either commercially or recreationally, for generations to come. They said that this is important at a personal, social and community level.
- At a personal level, commercial and recreational fishers often used the word 'passion' to describe their fishing activities. Although it is often hard work, fishing out on the sea or on the shore can be beneficial for fishers' mental health and general wellbeing.
- Commercial fishers also pointed out the importance of bass for their income. Bass is a highly profitable and popular fish in England and Wales catching premium prices.
- At a wider social level, commercial fishers and bass sellers pointed out the importance of bass fishing for national food security and the food supply chain. Allegedly, there are four jobs on the shore for every fisher on the sea.
- Recreational anglers also talked about the importance of angling for local economies. From tackle shop to fishing competition and charter boats, recreational fishing is considered crucial for the existence of coastal communities.

"My boss is the sea and the tide. It's solitude. It's different [from second job]. I've got to be honest it is the love."

Commercial fisher, Brighton

"One member [of stakeholder's bass angling group] is bipolar, angling has saved his life. He lives for bass fishing."

Recreational fisher, Stoke Gifford

A New Generation of Fishers

- Some commercial fishers expressed their fears about the future generation of fishers. Entering the bass fisheries is challenging, which can turn individuals away from pursuing this career. This is because of the high costs of buying a boat with a bass entitlement as well as other expenses, such as the required training courses, equipment and obtaining various licences.

- Fishers also report the burdens of day-to-day bureaucracy and navigating the complex fishing regulations, which can drive away young and inexperienced fishers.

- Fishers agree that government incentives, such as apprenticeship schemes, and financial help for new entrants into the industry could support the future generation of fishers.

"I've started from scratch, costs and paperwork - it's ridiculous. I was waiting for ages to get it."

Commercial fisher, Barrow-in-Furness

"It should be cheaper to get people trained and far more accessible. [...] £160 a [sea survival] course for someone who is unemployed is too much. "

Commercial fisher, Brighton

> ***"Finding the fish now [thanks to onboard technology] is easy and that's what's depleted the stocks."***
> Recreational fisher, Pembrokeshire

Towards a Sustainable Future

- All stakeholders agree that bass conservation is vital to preserve the environment, coastal communities and the livelihood of fishers.
- Some stakeholders, particularly rod and line commercial fishers, recreational fishers and environmental NGOs, are calling for the promotion of sustainable fishing gear and the phasing out of damaging fishing methods that can be detrimental to the environment and fish stocks.
- Some recreational fishers and charter boat skippers expressed their fears for the current advancements for onboard technologies for fishing (for example, sophisticated GPS systems); this could result in rapidly depleted bass stock levels in some areas due to precise targeting.
- Many stakeholders shared their ideas for achieving a more sustainable future, with some ideas including electrical boats, using lighter gear and advancing technology for more effective enforcement.

Fears for the Future

The other challenges mentioned in relation to the future of bass industry include:

- The digitalisation of paperwork (for example, recording of catches) because this could negatively impact fishers with limited digital and/or literacy skills.
- Introduction of more complex regulation, which could further limit the fishing time and add administrative work.
- The rising costs of living, ranging from fuel to ice, which means the income from fishing doesn't match the inflation.
- The pressures of EU Exit, as it is more difficult to send and sell bass abroad. Some perceive that enforcement of foreign boats fishing illegally in the UK has also lessened, and the prices for the workforce have gone up.
- The lack of governmental subsidies and support for bass fishers.

It's [bass] getting less market price [since leaving the EU] because it's a day older. You can't get fish that quick anymore because of the controls and checks at the border. It's a big problem with bass because it's a premium product."

Seller of bass, Brighton

"Everything is digital and there's little support for fishers without digital literacy or general literacy.

Commercial fisher, Barrow-in-Furness

Conclusion 1/2

What stakeholders' experiences suggest about the current bass regulatory system

- **Regulation is complex and rigid**
  Stakeholders agreed that the current regulation is complex, which makes it difficult to comprehend, abide by and enforce. There is a lot of administrative pressure on fishers, with often little help in terms of educational provision, digital literacy and navigating the licensing system.

- **Enforcement is not efficient**
  Stakeholders from across the system agree that the existing enforcement practice is not fit-for-purpose. Whilst some fishers report insufficient enforcement action, others find enforcement too punitive. Enforcement officers also report the lack of funding and resource.

- **Regulation that supports discards**
  The current regulatory system, in particular the regulation on 'unavoidable bycatch', leads to unnecessary discards of dead fish. This has detrimental impacts on bass stock levels and does not benefit any stakeholder group. Moving towards a future where discards are avoided has been mentioned as a top priority by a number of stakeholders.

Conclusion 2/2

- **A top-down approach**
  Many stakeholders spoke about the current top-down approach, which excludes fishers from decision-making processes. Making the government approaches more open and transparent - be it via citizen science or co-design - could make regulation more effective and relevant to different stakeholder groups and local contexts.

- **Tensions between stakeholder groups**
  A bass stakeholder landscape is diverse and often antagonistic, with some stakeholders questioning who should have a say in the decision-making process. Many stakeholders are calling for working collaboratively across the system to achieve a common goal.

- **An uneven playing field**
  Many stakeholders report an uneven playing field between different groups of stakeholders; this is often linked to a licensing system that, according to some, lacks fairness. Stakeholders also talked about uneven enforcement, prioritisation of some gear types and struggles to enter the industry as a newcomer.

- **Uncertain future for individuals and communities**
  Stakeholders across the system are concerned about the future of bass fishing in England and Wales. This is worrying at a personal level as people's livelihoods and wellbeing depend on fishing, but it is also important at a societal level due to the importance of bass fishing for food security, supply chain and coastal communities. Stakeholders are unison in hoping to achieve thriving and sustainable bass fishing in the future.

December 2022

Policy Lab

Department for Environment Food & Rural Affairs

Collective Intelligence debate: a summary

Seabass fisheries management plan 2023

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This report contains unpublished data which has not yet been quality assured by an analyst.

Overview

Since November 2021, Policy Lab have been experimenting with a digital debate platform called Pol.is. This tool allows policy-makers to reach the diversity of thought and experience that is distributed across groups of people in a particular policy area: their 'collective intelligence'.

Between Monday 15 and Tuesday 23 August 2022, Policy Lab facilitated an online Collective Intelligence (CI) debate as part of its work on the new Bass Fisheries Management Plan (FMP).

Each day participants logged onto the Pol.is website, where they were presented with a series of statements on sea bass topics. For each statement, participants could vote to agree, disagree or pass. They could also submit their own statements, which were moderated before being incorporated into the debate for other participants to vote on. Over the course of the week, the conversation evolved and moved through a wide variety of bass topics: from issues around by-catch to thoughts about nursery areas.

About Policy Lab

Policy Lab is a multidisciplinary team working openly and collaboratively across government, bringing expertise in policy, ethnography, systems thinking, futures and design.

We support the public sector to achieve better policy outcomes by partnering on innovative projects, leading and demonstrating best practice, and delivering training.

Since 2014, we have partnered with policy teams on over 170 projects, working with 7,000 public servants across central and local government departments and agencies, as well as internationally.

Policy Lab is a multi-award winning, and one of the world's longest-standing government Labs dedicated to policy innovation.

Our projects test new approaches which bring lived experience and experimentation into policymaking. We share our new tools and techniques openly on our blog and the Open Policy Making Toolkit to encourage system-wide transformation.

Project Timeline

Evidence Discovery and Expert Interviews
(April - May '22)

Lived Experience Research
(June - August '22)

Collective Intelligence Debate
(August '22)

A national conversation around the bass FMP.
Ideas for the new FMP helped shape co-design.

Co-Design
(September - November '22)

Co-Refine
(November - December '22)

Why we chose to do it

Collective Intelligence has played an important role in Policy Lab's work on the development of the bass FMP. It has provided:

- Stakeholders with:
    - the opportunity to put forward their own ideas for the new FMP, and have those tested by others in the system
    - Exposure to individuals and ideas they might not otherwise have encountered, as well as an understanding of where and to what extent different groups agree and disagree
- Policy Lab with a raft of stakeholder-led ideas and voting data to inform the subsequent co-design process
- DEFRA and Welsh government with:
    - A way for a significant sample of bass stakeholders from across the sector to come together at the same time, to have a "conversation" about the new FMP on a range of bass issues - something which had previously not been possible at scale
    - Access to individuals and parts of the bass world who might not have had the opportunity to engage with government consultation exercises before. This is because the debate was online, meaning people could take part from home and in their own time.

The debate, at a glance

276

total participants

137 recreational
and
110 commercial

267
in England

43
in Wales

Approximately 53% of all votes agreed with statements, 27% disagreed

Almost 140,000 votes on 711 statements

Over half
of all participants voted on all 711 statements

Statements covered **10** categories and **102** subcategories

213 rod/line users

72 Netters

15 Trawlers

14 Spears

15 Other gear users

Participants could identify with more than one stakeholder type, region and/or gear type

Methodology

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Advertising the debate

Anybody could take part in the debate, all they had to do was complete our general interest form and indicate that they had a particular interest in being involved in the CI process. To ensure that as many people as possible were made aware of the debate, Policy Lab carried out a coordinated communications campaign across June, July and August 2022.

The following groups were contacted and invited to share information about the debate with their members, as well as sign up themselves:

- Recreational groups such as the Angling Trust
- Fish producer organisations, such as the Cornish Fish Producers' Organisation (CFPO)
- All regional contacts for the Marine Management Organisation (MMO) and Inshore Fisheries and Conservation Authorities (IFCAs) (MMO shared information with all registered bass license holders)
- Scientists from the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and Plymouth University
- Seafish
- Natural England and the Environment Agency

The registration process

In total, 409 people expressed an interest in taking part in the debate and were provided with a username and password to access the debate platform. Of these people, 276 went on to actively participate in the debate.

During registration, Policy Lab collected three pieces of demographic information which were significant for the analysis of the debate:

- stakeholder type
- regions in which individuals fish/work
- gear used

Of the 276 people who took part in the debate, Policy Lab received this demographic information for 249 of them.

The debate saw particularly strong participation from both recreational and commercial fishers, rod and line and net users, as well as from the South West and southern regions of England. However, there was also representation from a variety of other areas, such as from scientists, spearfishers and individuals who fish/work in Wales. A detailed breakdown of the number of individuals from each category are shown in Tables 1a, 1b and 1c in the annex.

The debate week

The debate was originally scheduled to take place from Monday 15 August to Sunday 21 August, with participants being able to submit new statements until Friday 19. However, Policy Lab received a large number of registrations after the debate had started, with some people also not being able to login because of technical difficulties. The decision was therefore made to extend the debate to Tuesday 23, which gave the late starters enough time to engage with the process in the same way as other participants.

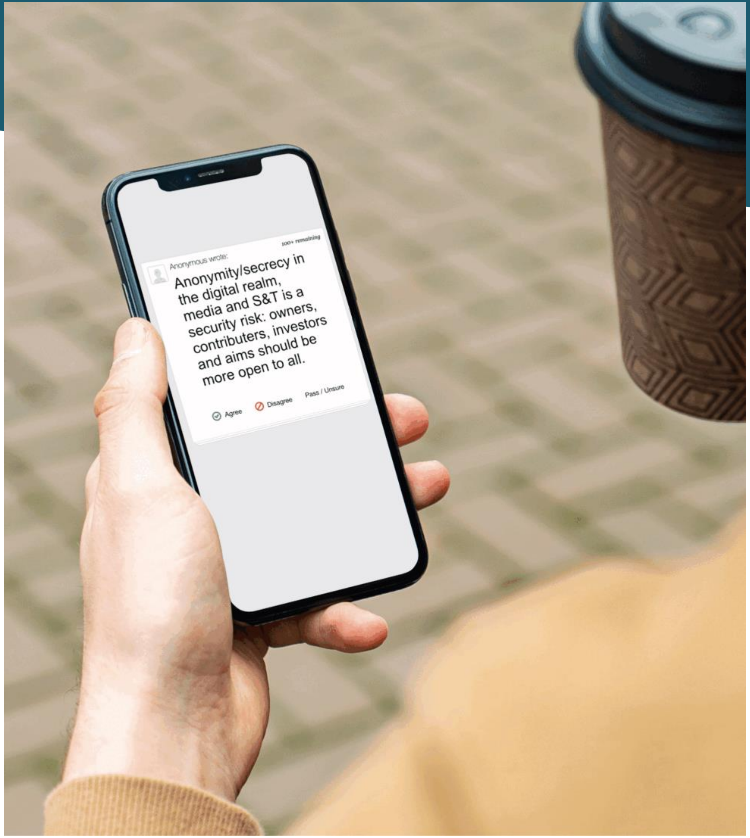
Throughout the week, Policy Lab worked behind the scenes to moderate the 2,213 statements which were submitted by participants. Statements were removed from the debate if they repeated existing ideas, were not relevant or if they were too complex for people to easily agree or disagree. Some statements were also modified in small ways to improve understanding (e.g. by writing out acronyms fully). 673 statements passed moderation and were entered back into the debate for other participants to vote on. The vast majority of rejections were because statements closely repeated existing ones. All of the moderation criteria are shown in Table 2 in the annex.

Engagement

Including the 38 "seed statements" which Policy Lab wrote to kick start the debate, there were a total of 711 statements in the debate. This generated almost 140,000 votes in total of which approximately 53% agreed and 27% disagreed with statements*. More than half of both recreational and commercial fishers voted on every single statement.

A detailed breakdown of engagement statistics by demographic information is shown in Tables 3a, 3b and 3c in the annex.

These percentages are approximate because they are based on the 249 people with known demographic information, rather than the voting data of all 276 participants



Categorising the statements

After the debate was complete, Policy Lab categorised all of the 711 statements into the following 10 categories (presented in this report in alphabetical order). This was achieved inductively, meaning the categories were decided as the statements were reviewed, not before.

- Authorisations and licences
- By-catch and discards
- Enforcement
- Management
- Markets and food supply
- Nurseries and other protected areas
- Regulation
- Science and evidence
- Stakeholder relationships
- Sustainability of the fishery

The statements were also ascribed to 102 sub-categories, which can be seen in Tables 4a and 4b in the annex. Approximate percentages of agree, disagree and pass/unsure votes per category are shown in Table 16.

Analysis of the results

Once the statements had been categorised, Policy Lab began the following **strands of analysis**:

1) Engagement and demographics: how many statements were submitted and votes cast, in total and by different demographic groups?
2) Areas of possible consensus/divergence: on which topic areas did recreational and fishers broadly agree/disagree?
3) Consistency across geographic regions: what is the spread of opinion across England and Wales?

Strand 2 was the focus of the analysis in the first instance because the co-design stage of Policy Lab's work on the bass FMP followed shortly after the CI debate. Identifying ideas for the new FMP which were also areas of consensus between recreational and commercial fishers provided useful talking points for the co-design workshops.

In addition to this report, which has been submitted to DEFRA and the Welsh government, Policy Lab published the initial findings from the debate. These were sent on 7th October to everyone who completed Policy Lab's general interest form.

Summary of the results

Guide to the results

The summary of results on the following slides and in the annex have been organised by category (in alphabetical order) and are presented accordingly:

1. A narrative around the statements, including an example statement with the percentage of all voters who agreed, disagreed and passed that statement
2. Analysis of the statements which show possible evidence of consensus/divergence between commercial and recreational fishers. Out of 711 statements in the debate, 142 statements showed possible evidence of consensus and 106 showed possible evidence of divergence. Table 15 shows data about possible consensus statements by category.
3. Analysis of the consistency/spread of opinion between geographic regions

'Possible consensus', 'possible divergence' and 'spread' are terms defined by Policy Lab. Definitions for the terms can be found at the end of the annex, along with important notes and caveats about the data.

Policy Lab have refrained from making comparisons and presenting analysis where unreliable data precludes it. This includes:

- Stakeholder types other than recreational and commercial fishers, because of low numbers of participants from these groups
- Gear types, either because of low numbers of participants from these groups and/or because of a high degree of overlap between gear types (namely, netters and rod and line) where participants identified with more than one gear type. Noteworthy results from statements which pertain to a specific gear type have been presented under each category, where possible and appropriate.

The full results and data can be found in the data file which accompanies this report. Some important limitations of the CI methodology are discussed at the end of the annex.

Authorisations and licenses

There were 74 statements in total for this category, which Policy Lab estimate had the lowest percentage of agree votes (42.0%) among all 10 categories.

A large proportion of the statements were focused on bass entitlements. 19 statements (and a further seven statements looking specifically at fishing methods) were focused on 'How entitlements work', discussing issues such as the flexibility of entitlements as well as whether it should be the boat or owner who holds the entitlement. A further 10 statements attended to the transfer of entitlements, posing statements such as "*There should be more clarity from MMO on the transfer of entitlement rights*". On the question of how many entitlements ought to be granted by authorities, 14 statements took the view that more should be granted or that the system needs to be fairer, while 12 argued for further restricting the number of entitlements, pointing to the divisive nature of this particular topic.

12 statements questioned whether recreational fishers and non-powered vessels ought to be subject to some kind of licensing, with statements such as "*Commercial fishing of bass from unpowered vessels should be authorised on exactly the same basis as powered boats*" receiving broad support across all stakeholders. Meanwhile, 70.0% of spear fishers disagreed with the statement '*spear fishing should be licensed*'

Authorisations and licenses (cont)

13 (17.6%) of the statements under this category showed possible evidence of consensus between recreational and commercial fishers. Table 5a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 5b shows the statements with strongest evidence of divergence. Table 5c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"A license fee for anglers could fund a truly representative voice for anglers"

Statement 665

By-catch and discards

There were 24 statements in total for this category (14 on by-catch and 10 on discards) which could be broadly sub-categorised under 'problems' and 'solutions'.

Regarding by-catch, a number of statements expressed a strong desire to reduce overall by-catch and either strengthen or clarify the regulation around it. There was also one statement pointing to the need to consider wider marine wildlife by-catch in the FMP. Participants put forward a range of possible ideas for what fishers should be forced to do with bass caught as bycatch. Some suggested these catches should be given to food banks and care homes; others explored the idea of fishers only receiving a small percentage of the sale of the catch, with the rest of the money being donated to research projects, stock recovery funds or to enforcement efforts; one statement considered whether by-catch ought to be reduced from any rod and line entitlement a boat may hold. No more than 23.1% of netters agreed with any of these proposals.

Regarding discards, the statements were similarly firm in their view that the current level of discarding of bass is unacceptable and that it is acting as an impediment to the success of the fishery. Large trawlers were identified by one statement as the root of this problem, to which 60% of trawlers who took part in the debate agreed ('*Lots of bass discards from large trawlers are the biggest problem with the current management of bass*').

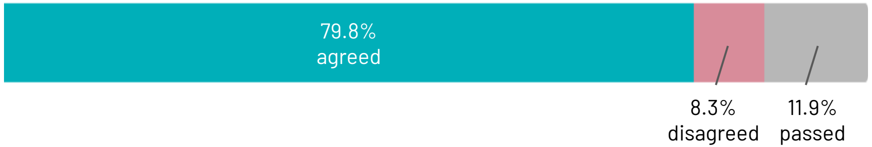
By-catch and discards (cont)

To address the discard problem, the statements suggested a much stronger system of monitoring monthly catches, with commercial fishers having to record and report the numbers of bass they discard, while one statement considered whether the issue of discards could be addressed if by-catch restrictions were relaxed.

Seven (29.2%) of the statements under this category showed possible evidence of consensus between recreational and commercial fishers: the second highest percentage of the ten categories. Table 6a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 6b shows the statements with strongest evidence of divergence.

Table 6c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"A successful fishery should have a minimum level of discards."
Statement 340



Enforcement

Participants submitted 105 unique statements on this topic representing 15% of the total number of statements in the debate. 'Enforcement' was the category which Policy Lab estimate had the highest percentage of agree votes (65.4%) among all 10 categories.

Statements outlining the problem with current enforcement focused on regulators' not being able to target enforcement effectively because of a lack of specialised knowledge, as well as the difficulties of delivering effective enforcement over long coastlines when regulators have so few vessels and officials. 68 of the 105 statements were suggestions for solutions to the existing problems with enforcement, which Policy Lab have grouped under the following sub-categories:

a) policing/monitoring, 21 statements covering issues such as the need for more funding and resource for regulators as well as how regulators could better target enforcement work with the resources they have

b) punishments/deterrents, 19 statements covering issues such as how stronger regulation (for example, the removal of bass authorisations) could prevent illegal fishing, the importance of having reliable landings data to support prosecutions and how sellers of bass could be prosecuted for handling illegally caught fish as a deterrent across the system

c) documentation/auditing, 15 statements covering issues such as the auditing of businesses, regulators' use of the Catch App, and ways of tracing fish through the system (for example, carcass tagging)

d) info/comms/training, seven statements covering issues such as how to better inform and educate recreational fishers and sellers of bass about the regulations, and how to help commercial fishers with the use of the Catch App

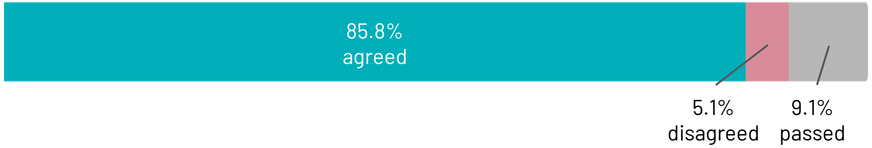
Enforcement (cont)

e) reporting, five statements covering issues such as the need for systems through which fishers can report illegal activity and the need to advertise these systems widely, as well as fishers general willingness to help regulators in preventing illegal activity

A further 15 statements detailed how illegal activity is carried out and how legal loopholes are taken advantage of, while 13 statements attended to how enforcement is managed: discussing the ineffectiveness of current enforcement and the need for better collaboration and data sharing between IFCAs and the MMO.

Among all 10 categories, the 'Enforcement' category has the highest percentage of statements (36.2%, 38 statements) which show evidence of possible consensus. Table 7a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 7b shows the statements with strongest evidence of divergence. Table 7c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"A fishery without effective enforcement is not a managed fishery."
Statement 336



Management

Participants submitted 147 unique statements on this topic constituting over a fifth of the total number of statements in the debate, making this category the second highest by number of statements. Participants discussed a wide range of management issues - from how the system is funded to management examples from around the world to follow - with Policy Lab summarising the most popular topics below.

A total of 31 statements were related to DEFRA, MMO and/or the IFCAs' management of the fishery. Here, statements were concerned with a number of issues, including perceived mismanagement of the fishery by DEFRA in the past, that officials do not stay in roles long enough to become effective, that IFCAs need to be more transparent in how they make decisions on bass, and the idea of merging the IFCAs and the MMO.

23 statements considered what the high-level strategies ought to be for the fishery, with 13 focusing on stock strategies such as maximum sustainable yield (MSY), "large stock" or those which address the stock structure, and 10 considering other strategy approaches such as "maximum economic yield" and "maximum social benefits".

A further distinct area of interest was the design of the FMP: the process of creating it, who gets to be involved and whether there ought to be separate FMPs for commercial and recreational fishers. 12 statements considered the FMP process, with participants discussing the pros and cons of this debate as well as ideas such as how mechanisms for stakeholder oversight could be built into future management of the fishery.

Management (cont)

19 (12.9%) of the statements under this category showed possible evidence of consensus between recreational and commercial fishers: the second lowest percentage of the ten categories. Table 8a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 8b shows the statements with strongest evidence of divergence. Table 8c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"The bass fishery is a societal asset and gov. should start managing it to generate the Maximum Sustainable Benefits for coastal communities."

Statement 1,864

Markets and food supply

There were 31 statements in total for this category, with sub-categories covering a range of varied topics. 11 statements were concerned with the public knowledge and perception of bass, with participants pointing out the need to educate the public around "the plight of bass" and encourage consumers and sellers of bass to consider alternative species. A total of seven statements discussed the merits and problems with farmed bass. Some statements saw the value of farmed bass as taking the pressure off wild stocks and providing employment opportunities, while others spoke of the environmental impact of fish farms, how farmed bass devalues the wild stock and wrongly gives the impression that the consumption of undersized bass is a positive outcome.

Five statements discussed the issue of exporting bass, with a number of statements expressing the view that exports of bass to foreign markets should be banned and/or that more bass should be sold locally in the UK. A further eight statements on the issues of documentation and regulation put forward a number of suggestions around buyers and sellers of bass, arguing for stronger regulation at that point in the system and that only independent fishmonger who are registered with the authorities ought to be allowed to buy and sell bass.

Markets and food supply (cont)

Six (19.4%) of the statements under this category showed possible evidence of consensus between recreational and commercial fishers. Table 9a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 9b shows the statements with strongest evidence of divergence. Table 9c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"Chefs and restaurants should refrain from promoting Bass as a special fish, and use more plentiful species."

Statement 2,184

Nurseries and other protected areas

A total of 29 unique statements were submitted by participants under this category. 11 of these focused on the idea of having more or bigger protected areas, with different statements suggesting varying ideas for which geographic areas could be protected and under what degree of regulation. Some statements focused on nursery areas, proposing that the number of such sites ought to be increased or that boundaries should be extended to protect the movements of aggregating shoals of bass. Other statements discussed the notion of 100% no-take zones in various locations, including all nearshore areas and in specific locations such as the Eddystone Reef. A further 11 statements focused specifically on the regulations in protected areas, reiterating ideas around strict regulations in nursery areas including on shore angling, while six statements attended to the management of such areas, exploring ideas such as whether power station water inlets could be better utilised as bass habitats. The following statement received 33.3% agreement and 49.0% disagreement from netters: '*Bass aggregation reefs such as the Eddystone should have a netting exclusion zone for gill netters enforceable by vessel monitoring tracking*'.

Nurseries and other protected areas (cont)

Six (20.7%) of the statements under this category showed possible evidence of consensus between recreational and commercial fishers. Table 10a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 10b shows the statements with strongest evidence of divergence. Table 10c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"Blue corridors should be created between known bass aggregation sites to protect migrating shoals of bass"

Statement 1,072

Regulation

There were a total of 155 statements in the debate which Policy Lab have categorised under 'Regulation' accounting for almost 22% of all the statements, making this category the most talked about issue in the debate (by number of statements). Participants discussed a wide range of regulation issues - from boat sizes to trawling - with Policy Lab summarising the most popular topics below. 'Regulation' was also the category which Policy Lab estimate had the second lowest percentage of agree votes (44.5%) among all 10 categories.

Statements under this category tended to convergence around what regulations should be in place for particular issues, predominantly different gear types. 36 statements considered rod and line regulations, discussing the pros and cons of existing regulations (for both commercial and recreational rod and line users), as well as how the use of certain types of hooks and bait could be regulated. 58.1% of rod and line users agreed that *"The use of treble hooks for recreational anglers to be prohibited to help prevent damage to juvenile fish"*. Meanwhile, 27 statements considered net regulations, attending to issues such as whether drift netting should be allowed or not, how regulations could apply by mesh size or type and how netting could be restricted in different geographic areas/localities. Two-thirds of netters agreed that *"At the very least Drift netters should have a Bass By-catch, discarding dead bass just because there is no anchor on the net makes no sense."*

Other convergence points for this category were around the size of bass (maxima, minima and slot sizes) and closed seasons, with a further 20 statements attending to the general approach and strategy towards regulation. Here, the interest was often towards the number and reach of the regulations, whether these ought to be extended or retracted, for the benefit of the stock and livelihoods, respectively.

Regulation (cont)

26 (16.8%) of the statements under this category showed possible evidence of consensus between recreational and commercial fishers. Table 11a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 11b shows the statements with strongest evidence of divergence. Table 11c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"The majority of Bass fishers want to abide by the regulations"

Statement 1,445

Science and evidence

A total of 72 unique statements were put forward by participants for this category, which Policy Lab estimate had the second highest percentage of agree votes (60.2%) among all 10 categories. Eight statements debated the importance of the science for the FMP, with many statements imploring for the FMP be based first and foremost on scientific evidence, even if this conflicts with fishers' own views. However, confidence in the current scientific assessments appear to be low. 61.2% of recreational fishers and 78.4% of commercial fishers disagreed with the assessment that "*Fisheries science is highly accurate.*"

29 statements considered the different topic areas which participants would like to see scientists focus on in their work. Here, 10 statements suggested that more research is needed into the socio-economics of the fishery (on both the commercial and recreational side), such as the impact of management decisions on coastal communities. A further 9 statements argued for a focus on the bass life cycle or more attention on stock levels and structures.

12 statements considered the importance of collecting and monitoring accurate landings data to support scientific work, while a further 5 discussed alternative methods of data collection, including the idea of having fishers (recreational and commercial) act as collectors. Relatedly, of the 12 statements under the sub-category 'Fishers' knowledge', a number debated whether the knowledge and understanding which fishers have ought to be valued alongside the evidence provided by the science.

Science and evidence (cont)

15 (20.8%) of the statements under this category showed possible evidence of consensus between recreational and commercial fishers. Table 12a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 12b shows the statements with strongest evidence of divergence. Table 12c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"A Bass FMP will not be truly effective unless it complies, or adheres closely to scientific recommendations for catch."

Statement 936

Stakeholder relationships

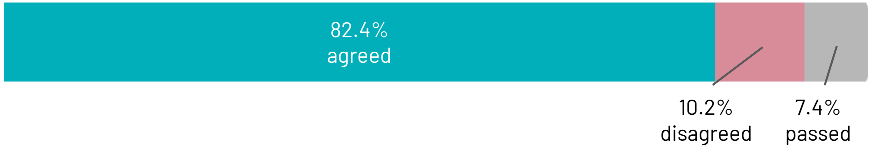
There were 36 statements in total for this topic, which Policy Lab have arranged into sub-categories along the lines of the relationships between the stakeholder groups referred to in the statements. 15 of the statements were grouped under 'Fishers, commercial fishers, recreational', demonstrating the significance of this relationship for the success of the FMP. A number of these statements spoke positively or hopefully about the relationship, making reference to 'working together' as something which is both desirable and achievable.

A further 12 statements were concerned with DEFRA's relationship to fishers and the IFCAs. Regarding the former, some statements were critical of DEFRA for not having involved fishers sufficiently well in the past, others questioned the lobbying power that certain sectors have over the organisation, while two spoke positively about fishers having been much more engaged in the decision-making process in recent times. The remaining statements covered a range of different areas, including the perceived inequality of the catch allocations given to netters and rod and line fishers; 58.7% of netters agreed with the statement '*the kg allowance difference between line and net caught bass is completely [sic] unfair and bias*'

Stakeholder relationships (cont)

Eight (22.2%) of the statements under this category showed possible evidence of consensus between recreational and commercial fishers. Table 13a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 13b shows the statements with strongest evidence of divergence. Table 13c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"Commercial and recreational fishers should work together to achieve a bass fishery which meets the needs and aspirations of both"
Statement 119



Sustainability of the fishery

There were 38 statements in total for this category, with fishers interpreting a range of different meanings of sustainability. 11 statements focused on the importance of maintaining economic sustainability for the jobs and livelihoods that make up the fishery, not just in the commercial sector but also in the recreational sector. A number of statements pointed to how bass guides, charter skippers and tackle shop owners are as dependent on healthy stocks for their livelihoods as other stakeholders. A further seven statements considered young/new commercial fishers, with participants proposing a number of ideas for how to ensure the industry thrives, such as the transfer of entitlements from retiring older fishers and ways to incentivise new fishers to fish sustainably.

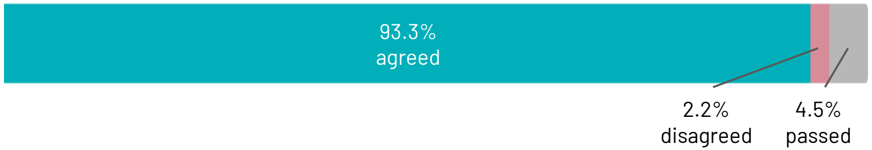
Nine statements assessed the sustainability of different gear types and methods, with a majority of statements arguing either for or against the sustainability of netting (both gill and drift) as a method of capture. For example, nine out of 10 netters agreed with the statement: ‘*Netting can be done sustainably and with little impact, but all depends on quantity of net and the individual doing it.*’ A final seven statements reflected on the importance of sustainability and long-term thinking for the success of the fishery. Five of these statements use the word ‘future’, either concerning bass stocks or the next generations of fishers, indicating the desire to see current issues resolved for the sake of bass fishing surviving into the future.

Sustainability of the fishery (cont)

Among all 10 categories, the 'Sustainability of the fishery' category has the lowest proportion of statements (10.5%, four statements) which show evidence of possible consensus. Table 14a in the annex shows the three statements under this category which show the strongest evidence of consensus between the two groups, while Table 14b shows the statements with strongest evidence of divergence. Table 14c looks at the consistency of opinion across the geographic regions, showing the statements under this category with most and least spread (highest and lowest standard deviations, respectively).

"Sustainability of the bass stock is in everyone's interest"

Statement 1,431



Annex

The number of participants who took part in the debate from each stakeholder type (Table 1a), region (1b) and gear (1c)

Stakeholder type	Number of participants
Recreational	137
Commercial	110
Charter vessel	10
Representative body	16
Buyer of bass	6
Research/science	11
Local/central government and/or regulation	6
Other	5

Table 1a: the number of participants who took part in the debate from each stakeholder type

Region fished/worked	Number of participants
East of England (inc East Midlands)	27
South East (inc London)	31
South (Hampshire, Dorset)	66
South West	120
North East (inc Yorkshire)	11
North West	12
Wales, South (inc Bristol, Gloucs and Somerset)	20
Wales, Mid and North	23
Other Region	39

Table 1b: the number of participants who took part in the debate from each region fished/worked

Gear used	Number of participants
Trawl	15
Nets	72
Rod and line and/or other line types	213
Spears	14
N/A	0
Other Gear	15

Table 1c: the number of participants who took part in the debate from each gear used

Participants could identify with more than one stakeholder group/region/gear if relevant to them, and therefore would be counted in each group. For example, an individual might have indicated that they were both a recreational fisher and a charter vessel skipper, in which case they would be part of the counts for both recreational fishers and charter vessel skippers. Note that the count for 'Rod and line and/or other line types' includes both commercial and recreational fishers.

The criteria used by Policy Lab to moderate Collective Intelligence debates (Table 2)

	New statements must...
1	Not be written in response to existing statements - they will not appear alongside the original statement in the debate, so others won't understand the context.
2	Be relevant to the topic under discussion (any issues related to bass and the new FMP, whether to do with fishing, management, science, regulation, buying/selling, secondary impacts of the sector on the economy/society etc).
3	Be written as a statement, not a question (people must be able to agree or disagree with what is written).
4	Communicate one idea, in no more than two sentences, which others can agree or disagree with.
5	Not use offensive language.
6	Not repeat ideas already communicated in existing statements.

Table 2: the criteria used by Policy Lab to moderate Collective Intelligence debates

Debate engagement statistics by stakeholder type (Table 3a)

		Statements			Votes				
	Number of participants	Number submitted	Total approved	Percentage approved	Number of votes	Percentage agree	Percentage disagree	Percentage pass/unsure	Average per person (median)
Recreational	137	1,287	388	30.1	77,078	57.1	22.4	20.4	711
Commercial	110	860	270	31.4	57,324	47.4	33.9	18.7	711
Charter vessel	10	20	8	40.0	5,525	52.8	24.8	22.4	712
Representative body	16	113	37	32.7	7,577	54.1	25.5	20.4	528
Buyer of bass	6	18	9	50.0	2,925	43.9	36.0	20.1	582
Research/science	11	76	32	42.1	5,153	57.4	22.4	20.2	583
Local/central government and/or regulation	6	71	31	43.7	3,095	52.3	22.5	25.2	585
Other	5	18	7	38.9	1,787	60.7	12.2	27.1	382

Table 3a: debate engagement statistics by stakeholder type

Debate engagement statistics by region fished/worked (Table 3b)

		Statements			Votes				
	Number of participants	Number submitted	Total approved	Percentage approved	Number of votes	Percentage agree	Percentage disagree	Percentage pass/unsure	Average per person (median)
East of England (inc East Midlands)	27	135	43	31.9	12,923	48.5	28.1	23.4	582
South East (inc London)	31	377	114	30.2	15,036	47.8	31.8	20.4	583
South (Hampshire, Dorset)	66	573	163	28.4	35,623	52.8	27.7	19.5	711
South West	120	1,037	308	29.7	64,848	53.9	25.4	20.7	711
North East (inc Yorkshire)	11	68	27	39.7	6,471	60.2	26.7	13.1	712
North West	12	79	30	38.0	5,458	49.6	35.1	15.3	535
Wales, South (inc Bristol, Gloucs and Somerset)	20	199	65	32.7	12,197	58.8	21.6	19.6	712
Wales, Mid and North	23	93	34	36.6	10,647	56.8	20.6	22.6	530
Other Region	39	242	91	37.6	18,501	57.4	21.6	21.0	530

Table 3b: debate engagement statistics by region fished/worked

Debate engagement statistics by gear used (Table 3c)

		Statements			Votes				
	Number of participants	Number submitted	Total approved	Percentage approved	Number of votes	Percentage agree	Percentage disagree	Percentage pass/unsure	Average per person (median)
Rod and line and/or other line types	213	1,969	602	30.6	116,682	53.6	27.0	19.4	711
Nets	72	461	132	28.6	35,025	44.8	38.5	16.7	619
Trawl	15	43	13	30.2	7,038	42.6	39.5	17.9	583
Spears	14	66	14	21.2	6,849	52.2	24.4	23.4	523
Other Gear	15	73	36	49.3	5,052	47.1	24.1	28.8	252
N/A	0	0	0	N/A	0	N/A	N/A	N/A	N/A

Table 3c: debate engagement statistics by gear used

The 10 categories and 102 sub-categories under which the statements were grouped (Table 4a)

Categories	Sub-categories (separated by semicolons)
Authorisations and licences	How entitlements work; How entitlements work, fishing methods; Number of entitlements, increase/fairer; Number of entitlements, restrict; Other licences, non-powered vessels; Other licences, recreational; Transfers of entitlements
By-catch and discards	By-catch, solutions; By-catch, the problem; Discards, solutions; Discards, the problem
Enforcement	Illegal activity/loopholes; Management of enforcement; Problems with enforcement, by-catch definition; Problems with enforcement, knowledge of illegal fishing; Problems with enforcement, lack of resource; Problems with enforcement, price of bass; Solutions for enforcement, documentation/auditing; Solutions for enforcement, info/comms/training; Solutions for enforcement, other; Solutions for enforcement, policing/monitoring; Solutions for enforcement, punishment/deterrents; Solutions for enforcement, reporting
Management	Consulting stakeholders; DEFRA's management; EU/international issues; Examples to follow; FMP design, one/two FMPs; FMP design, process; FMP design, who's involved; Funding; MMO and IFCA's management; Proactive management; Regional vs. national, pro national; Regional vs. national, pro regional; Rep. bodies management; Single species vs. multi-species/ecosystem approach; Stakeholders to prioritise; Strategies/aims, non-stock; Strategies/aims, stock; Wider ecosystem, food for bass; Wider ecosystem, seals; Wider ecosystem, wildlife by-catch
Markets and food supply	Documentation; Exports; Farmed bass; Public knowledge/perception; Regulation
Nurseries and other protected areas	Fewer/smaller nurseries/protected areas; Management of nurseries/protected areas; More/bigger nurseries/protected areas; Regulations in nurseries/protected areas

Table 4a: 10 categories and 102 sub-categories under which all 711 statements were grouped (One sub-category and one category per statement)

The 10 categories and 102 sub-categories under which the statements were grouped (cont) (Table 4b)

Categories	Sub-categories (separated by semicolons)
Regulation	Bass size, maximum; Bass size, minimum; Bass size, slot size; Boat size; Charter vessels; Closed seasons, less strict; Closed seasons, maintain/stricter; Closed seasons, more flexible closures; Closed seasons, recreational vs. commercial; Closed seasons, regional vs. national; Nets, catch regulations; Nets, drift and fixed; Nets, geographic regulations; Nets, mesh type/size; Other methods/boat types; Perceptions of regulations; Regulation strategy; Regulation strategy, maintain/less strict; Regulation strategy, stricter; Rod and line, bait/hooks; Rod and line, commercial; Rod and line, recreational; Trawlers, banning; Trawlers, catch regulations; Trawlers, geographic regulations
Science and evidence	Confidence in data/science; Data collection; Fishers' knowledge; Importance of the science; Landings data; Landings data, recreational; Research focus, bass life cycle; Research focus, nursery areas; Research focus, other; Research focus, socio-economics; Research focus, stock levels and profile
Stakeholder relationships	DEFRA <-> fishers; DEFRA <-> fishers, commercial; DEFRA <-> fishers, recreational; DEFRA <-> IFCA; Fishers, commercial <-> fishers, recreational; Fishers, rod and line <-> fishers, netters; Fishers, trawlers <-> fishers; MMO <-> IFCA; Social media
Sustainability of the fishery	Gear/methods; Importance of sustainability; Jobs and livelihoods; Value of recreational fishing; Young/new commercial fishermen

Table 4b: 10 categories and 102 sub-categories under which all 711 statements were grouped (One sub-category and one category per statement)(cont)

Approximate percentages of agree, disagree and pass/unsure votes by category (Table 16)

Category	Total number of votes	Percentage agree	Percentage disagree	Percentage pass/unsure
Authorisations and licenses	13,381	42.0	33.8	24.2
By-catch and discards	4,637	57.1	22.8	20.0
Enforcement	19,258	65.4	17.5	17.0
Management	27,266	55.0	24.2	20.8
Markets and food supply	5,193	51.7	28.7	19.6
Nurseries and other protected areas	5,243	59.2	24.8	15.9
Regulation	28,807	44.5	35.6	19.9
Science and evidence	13,180	60.2	19.0	20.8
Stakeholder relationships	6,761	51.5	27.4	21.2
Sustainability of the fishery	6,914	51.3	28.9	19.8
Total	**130,640**	**53.1**	**26.8**	**20.1**

Table 16: Approximate percentages of agree, disagree and pass/unsure votes by category. ***Note: these percentages are approximate because they are based on the 249 people with known demographic information, rather than the voting data of all 276 participants***

The three statements from the 'Authorisations and Licences' category which show the strongest evidence of consensus between recreational and commercial fishers (Table 5a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	Authorisations and licenses	How entitlements work	Commercial licences should only be held by UK nationals tax resident in the UK.	Agreement with the statement	83.6	86.2	**84.9**
2	Authorisations and licenses	Other licenses, non-powered vessels	all commercial fishing for bass including from non-powered vessels should be licensed.	Agreement with the statement	88.0	75.9	**81.9**
3	Authorisations and licenses	Number of entitlements, increase/fairer	ALL under 6 metre vessels should be allowed to catch bass on lines, whether they have had an entitlement in the past or not.	Disagreement with the statement	72.0	57.3	**64.7**

Table 5a: the three statements from the 'Authorisations and Licences' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the 'Authorisations and Licences' category which show the strongest evidence of <u>divergence</u> between recreational and commercial fishers (Table 5b)

Rank	Category	Sub-category	Statement	Recreational fishers that agreed (%)	Commercial fishers that disagreed (%)	Average % between the two groups	Recreational fishers that disagreed (%)	Commercial fishers that agreed (%)	Average % between the two groups
1	Authorisations and licenses	Transfers of entitlements	Fishers should not be allowed to profit from selling a vessel with bass entitlement, given that they didn't pay for bass authorisation in the first place.	79.8	60.3	**70.0**			
2	Authorisations and licenses	How entitlements work, fishing methods	If you have a bass entitlement it should not matter what gear type you use to catch them.				76.2	55.1	**65.7**
3	Authorisations and licenses	Number of entitlements, restrict	Allowing under 6m to have a free for all will decimate the stocks.	77.7	48.2	**63.0**			

Table 5b: the three statements from the 'Authorisations and Licences' category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the 'Authorisations and Licences' category showing the largest and smallest spread of opinion across the regions (Table 5c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
Authorisations and licenses	Other licenses, recreational	Anglers who want more than 2 fish limit should be made to pay for a yearly quota/license and the money should be put into funding science.	**22.9**	66.7	34.8	42.3	46.6	66.7	0.0	x	53.3
Authorisations and licenses	Other licenses, recreational	Spear fishing should be licenced.	**21.1**	x	43.8	x	62.3	62.5	x	78.6	100.0
Authorisations and licenses	Number of entitlements, restrict	Removing the Bass Permit authorisation would generate a Free-for-All amongst commercial fishers and decimate stocks.	**20.5**	44.4	x	x	60.7	x	83.3	94.1	85.7

The six statements from the 'Authorisations and Licences' category showing the largest and smallest spread of opinion across the regions (cont) (Table 5c)

Authorisations and licenses	Number of entitlements, restrict	Removing the bass authorisation needed to land bass commercially would lead to overfishing and another collapse of the stock.	**7.6**	x	65.2	71.7	64.9	x	75.0	83.3	80.0
Authorisations and licenses	How entitlements work, fishing methods	Commercial vessels should be allowed to carry more than one type of gear on their boat.	**6.2**	x	44.4	35.4	32.4	45.5	45.5	x	x
Authorisations and licenses	How entitlements work	Commercial licences should only be held by UK nationals/tax resident in the UK.	**5.6**	95.2	90.5	86.3	84.0	100.0	x	88.9	86.7

Table 5c: looking at only the percentage of people who agreed, the six statements from the 'Authorisations and Licences' category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was "c"

The three statements from the 'By-catch and discards' category which show the strongest evidence of <u>consensus</u> between recreational and commercial fishers (Table 6a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	By-catch and discards	Discards, the problem	A successful fishery should have a minimum level of discards.	Agreement with the statement	80.4	80.0	**80.2**
2	By-catch and discards	By-catch, the problem	Minimise bass bycatch.	Agreement with the statement	92.3	61.1	**76.7**
3	By-catch and discards	By-catch, the problem	Unavoidable by-catch should be much more clearly defined in order to stop illegal targeting of bass.	Agreement with the statement	92.9	54.1	**73.5**

Table 6a: the three statements from the 'By-catch and discards' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the 'By-catch and discards' category which show the strongest evidence of divergence between recreational and commercial fishers (Table 6b)

Rank	Category	Sub-category	Statement	Recreational fishers that agreed (%)	Commercial fishers that disagreed (%)	Average % between the two groups	Recreational fishers that disagreed (%)	Commercial fishers that agreed (%)	Average % between the two groups
1	By-catch and discards	By-catch, the problem	The current regulations around by-catch for trawlers and netters are too generous.	85.6	60.0	**72.8**			
2	By-catch and discards	By-catch, solutions	Fishers selling "by-catch" should only be paid 10% of its value as a disinsentiviser, with the rest of the value going to research projects.	73.0	67.7	**70.4**			
3	By-catch and discards	By-catch, solutions	Vessels catching bass as by-catch should only be paid 10% of their market value and the rest given to a stock recovery fund.	74.6	62.6	**68.6**			

Table 6b: the three statements from the 'By-catch and discards' category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the 'By-catch and discards' category showing the largest and smallest spread of opinion across the regions (Table 6c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
By-catch and discards	Discards, solutions	Fishers should have to record and report the numbers of bass they discard.	**15.0**	57.7	66.7	82.3	72.6	90.0	54.5	95.0	85.7
By-catch and discards	By-catch, the problem	Unavoidable by-catch should be much more clearly defined in order to stop illegal targeting of bass.	**14.0**	52.2	63.0	87.7	81.1	80.0	x	89.5	85.0
By-catch and discards	Discards, the problem	It does not make sense to have commercial vessels landing bass one day and dumping dead bass the next, just because they changed gear.	**14.0**	75.0	x	55.1	x	x	75.0	43.8	71.4

The six statements from the 'By-catch and discards' category showing the largest and smallest spread of opinion across the regions (cont) (Table 6c)

By-catch and discards	By-catch, the problem	By-catch should not be treated as an allowance or quota, there needs to be a way of insuring it is accidental.	**10.6**	64.7	x	76.5	71.4	62.5	x	88.2	85.7
By-catch and discards	By-catch, the problem	Minimise bass bycatch.	**10.3**	x	65.2	87.3	80.4	90.0	x	94.7	86.7
By-catch and discards	By-catch, the problem	Impacts on the wider marine environment including wildlife bycatch needs to be considered in Bass FMPs.	**10.0**	60.9	78.3	74.6	76.6	90.9	x	89.5	78.9

Table 6c: looking at only the percentage of people who agreed, the six statements from the 'By-catch and discards' category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was "c"

The three statements from the 'Enforcement' category which show the strongest evidence of consensus between recreational and commercial fishers (Table 7a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	Enforcement	Solutions for enforcement, info/comms/training	Signs / information boards on size and catch limits, nursery areas, bylaws etc. to be installed to inform recreational anglers.	Agreement with the statement	89.4	85.0	**87.2**
2	Enforcement	Solutions for enforcement, reporting	Displaying information on how to report illegal bass fishing should be made more prominent at popular locations and all UK harbours.	Agreement with the statement	94.5	79.0	**86.8**
3	Enforcement	Solutions for enforcement, info/comms/training	Communications on regulations for bass should be directed at pubs, restaurants and hotels, so they do not fall foul of the rules.	Agreement with the statement	90.9	82.1	**86.5**

Table 7a: the three statements from the 'Enforcement' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the 'Enforcement' category which show the strongest evidence of divergence between recreational and commercial fishers (Table 7b)

Rank	Category	Sub-category	Statement	Recreational fishers that agreed (%)	Commercial fishers that disagreed (%)	Average % between the two groups	Recreational fishers that disagreed (%)	Commercial fishers that agreed (%)	Average % between the two groups
1	Enforcement	Solutions for enforcement, policing/monitoring	All vessels fishing for bass should have cameras onboard for transparency and accountability.	71.6	80.7	**76.1**			
2	Enforcement	Illegal activity/loopholes	The main loophole is the significant bycatch allowance for bass for netters.	85.8	56.4	**71.1**			
3	Enforcement	Illegal activity/loopholes	A ban on the targeted netting of bass using the "accidental" bycatch loophole must be ended, the same boats hit the same spots every winter.	91.3	49.5	**70.4**			

Table 7b: the three statements from the 'Enforcement' category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the 'Enforcement' category showing the largest and smallest spread of opinion across the regions (Table 7c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
Enforcement	Illegal activity/loopholes	The main loophole is the significant bycatch allowance for bass for netters.	**19.6**	41.7	44.4	68.3	67.9	54.5	x	89.5	89.5
Enforcement	Solutions for enforcement, reporting	Commercial fisherman can be the MMO/IFCA's eyes and ears with a monitoring and reporting system.	**18.4**	61.9	27.3	x	x	77.8	55.6	x	50.0
Enforcement	Solutions for enforcement, punishment/deterrents	Poaching, illegal fishing, and illegal killing of bass should be enforced by custodial sentences for offenders by the Courts.	**18.2**	x	50.0	62.7	68.1	x	50.0	93.8	85.7

The six statements from the 'Enforcement' category showing the largest and smallest spread of opinion across the regions (cont) (Table 7c)

Enforcement	Solutions for enforcement, policing/monitoring	Non powered vessels ie licenced kayaks, should have to be fitted with inshore vessel monitoring systems (IVMS), the same as all commercial vessels, to stop them fishing in nurseries.	**6.5**	60.0	63.6	53.7	69.8	70.0	x	66.7	56.3
Enforcement	Solutions for enforcement, punishment/deterrents	Huge fines for people selling fish with no license.	**6.5**	82.4	85.0	87.2	90.8	87.5	100.0	100.0	92.3
Enforcement	Solutions for enforcement, policing/monitoring	The MMO and IFCA should target and police recreational vessels more often.	**5.1**	60.9	61.5	61.7	70.4	72.7	60.0	x	66.7

Table 7c: looking at only the percentage of people who agreed, the six statements from the 'Enforcement' category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was "c"

The three statements from the 'Management' category which show the strongest evidence of consensus between recreational and commercial fishers (Table 8a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	Management	FMP design, process	Any bass management plan should have clear and concise aims and objectives where outcomes are measured and reported.	Agreement with the statement	94.3	85.7	**90.0**
2	Management	FMP design, process	For full transparency on this online debate, the results should be made public.	Agreement with the statement	94.2	83.8	**89.0**
3	Management	Strategies/aims, stock	More and bigger bass is good for everyone.	Agreement with the statement	93.1	77.8	**85.4**

Table 8a: the three statements from the 'Management' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the ‘Management’ category which show the strongest evidence of divergence between recreational and commercial fishers (Table 8b)

Rank	Category	Sub-category	Statement	Recreational fishers that agreed (%)	Commercial fishers that disagreed (%)	Average % between the two groups	Recreational fishers that disagreed (%)	Commercial fishers that agreed (%)	Average % between the two groups
1	Management	Consulting stakeholders	Recreational fishers should have a say in regulation pertaining to commercial bass fishing.	86.6	81.9	**84.2**			
2	Management	MMO and IFCA's management	The MMO and IFCA should give greater support to commercial bass fishermen, not recreational anglers.				85.8	80.0	**82.9**
3	Management	DEFRA's management	With respect to bass management DEFRA have prioritised commercial interests over sustainability.	89.0	76.2	**82.6**			

Table 8b: the three statements from the ‘Management’ category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the 'Management' category showing the largest and smallest spread of opinion across the regions (Table 8c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
Management	Wider ecosystem, wildlife by-catch	Netting close to shore does immeasurable damage to wildlife ie birds, seals and cetaceans.	**21.6**	31.3	50.0	55.8	70.8	x	x	93.8	73.3
Management	FMP design, who's involved	Industries who are benefiting from bass fishing indirectly (restaurants, tackle shops) need to be more involved in this FMP.	**21.0**	x	39.1	53.8	53.4	87.5	66.7	x	92.9
Management	FMP design, process	This online debate favours recreational fishers as commercial fishers tend not to be online.	**20.9**	47.4	39.1	29.6	31.6	x	62.5	0.0	x
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The six statements from the 'Management' category showing the largest and smallest spread of opinion across the regions (cont) (Table 8c)

Management	FMP design, one/two FMPs	The Bass stock will not flourish if we continue to work separately towards different goals.	**5.6**	x	x	67.3	74.2	77.8	x	77.8	82.4
Management	FMP design, process	Defra should explain, with examples, how it will ensure that all fishery managers will do what they need to, to deliver the Bass FMP.	**5.6**	78.9	73.9	78.4	x	77.8	x	88.9	x
Management	FMP design, process	For full transparency on this online debate, the results should be made public.	**4.7**	88.9	90.0	86.0	89.7	100.0	88.9	94.4	85.7

Table 8c: looking at only the percentage of people who agreed, the six statements from the 'Management' category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was "c"

The three statements from the 'Markets and food supply' category which show the strongest evidence of consensus between recreational and commercial fishers (Table 9a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	Markets and food supply	Farmed bass	Bass sold under 42cm should clearly show that they are farmed.	Agreement with the statement	92.5	87.2	**89.8**
2	Markets and food supply	Documentation	Bass sold as "line-caught" in catering establishments needs to be proven to be so by those selling it.	Agreement with the statement	90.9	70.3	**80.6**
3	Markets and food supply	Documentation	Bass caught commercially should go to registered buyers only.	Agreement with the statement	75.0	65.0	**70.0**

Table 9a: the three statements from the 'Markets and food supply' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the 'Markets and food supply' category which show the strongest evidence of <u>divergence</u> between recreational and commercial fishers (Table 9b)

Rank	Category	Sub-category	Statement	<u>Recreational</u> fishers that <u>agreed</u> (%)	<u>Commercial</u> fishers that <u>disagreed</u> (%)	Average % between the two groups	<u>Recreational</u> fishers that <u>disagreed</u> (%)	<u>Commercial</u> fishers that <u>agreed</u> (%)	Average % between the two groups
1	Markets and food supply	Public knowledge/perception	Chefs and restaurants should refrain from promoting Bass as a special fish, and use more plentiful species.	75.5	71.0	**73.2**			
2	Markets and food supply	Public knowledge/perception	All commercial caught and sold bass should have a label attached stating bass stocks are limited and unsustainable in the long term.	51.9	79.7	**65.8**			
3	Markets and food supply	Exports	Ban the export of bass to foreign markets.	61.8	68.0	**64.9**			

Table 9b: the three statements from the 'Markets and food supply' category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the 'Markets and food supply' category showing the largest and smallest spread of opinion across the regions (Table 9c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
Markets and food supply	Farmed bass	Ban the selling of farmed bass that devalues the fish and gives an impression of it being ok to eat undersize bass.	**19.4**	29.4	33.3	34.6	40.9	55.6	83.3	x	31.3
Markets and food supply	Public knowledge/perception	There needs to be a stakeholder wide acceptance that there is a problem.	**17.7**	62.5	x	x	67.8	77.8	x	100.0	100.0
Markets and food supply	Public knowledge/perception	All commercial caught and sold bass should have a label attached stating bass stocks are limited and unsustainable in the long term.	**16.6**	x	28.6	46.8	38.8	x	x	73.3	45.5

The six statements from the ‘Markets and food supply’ category showing the largest and smallest spread of opinion across the regions (cont) (Table 9c)

Markets and food supply	Documentation	Bass caught commercially should go to registered buyers only.	**6.7**	75.0	x	68.3	75.7	62.5	x	78.6	80.0
Markets and food supply	Farmed bass	People who suggest fish farming as an alternative should look in to the shocking environmental impact of fish farms and fish feed sources.	**6.0**	83.3	x	90.2	85.5	100.0	x	85.7	88.9
Markets and food supply	Documentation	Bass sold as "line-caught" in catering establishments needs to be proven to be so by those selling it.	**4.1**	x	x	83.0	89.3	87.5	x	93.8	91.7

Table 9c: looking at only the percentage of people who agreed, the six statements from the ‘Markets and food supply’ category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was “c”

The three statements from the 'Nurseries and other protected areas' category which show the strongest evidence of consensus between recreational and commercial fishers (Table 10a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	Nurseries and other protected areas	Regulations in nurseries/protected areas	There should be no bass angling competitions in nursery/protected areas.	Agreement with the statement	80.9	88.5	**84.7**
2	Nurseries and other protected areas	Regulations in nurseries/protected areas	Shore anglers should return any bass caught in a bass nursery area.	Agreement with the statement	81.2	85.2	**83.2**
3	Nurseries and other protected areas	Regulations in nurseries/protected areas	Drift netting should be allowed in estuaries because the ban has decimated many of the boats main income source with very few other species to fish for.	Disagreement with the statement	86.4	56.1	**71.2**

Table 10a: the three statements from the 'Nurseries and other protected areas' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the 'Nurseries and other protected areas' category which show the strongest evidence of divergence between recreational and commercial fishers (Table 10b)

Rank	Category	Sub-category	Statement	**Recreational** fishers that **agreed** (%)	**Commercial** fishers that **disagreed** (%)	Average % between the two groups	**Recreational** fishers that **disagreed** (%)	**Commercial** fishers that **agreed** (%)	Average % between the two groups
1	Nurseries and other protected areas	More/bigger nurseries/protected areas	Large inshore protected areas with no commercial fishing would encourage and support a sustainable sport fishing industry.	87.1	70.9	**79.0**			
2	Nurseries and other protected areas	Regulations in nurseries/protected areas	All methods of fishing whether recreational or commercial should be stopped in areas where no commercial fishing is permitted .				65.3	63.9	**64.6**
3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 10b: the three statements from the 'Nurseries and other protected areas' category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the 'Nurseries and other protected areas' category showing the largest and smallest spread of opinion across the regions (Table 10c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
Nurseries and other protected areas	More/bigger nurseries/protected areas	Nearshore areas are essential habitat for bass and delicate ecosystems, so we must protect them from netting and trawling.	**17.3**	41.7	55.6	76.7	75.7	70.0	x	94.7	80.0
Nurseries and other protected areas	More/bigger nurseries/protected areas	Protect spawning and pre-spawning bass aggregations from netting and trawling.	**17.3**	52.4	63.6	88.9	80.6	x	x	100.0	83.3
Nurseries and other protected areas	More/bigger nurseries/protected areas	Large inshore protected areas with no commercial fishing would encourage and support a sustainable sport fishing industry.	**14.0**	50.0	x	65.5	57.1	70.0	x	88.9	77.8

The six statements from the ‘Nurseries and other protected areas’ category showing the largest and smallest spread of opinion across the regions (cont) (Table 10c)

Nurseries and other protected areas	Regulations in nurseries/protected areas	Nurseries should have a complete ban on all types of fishing both recreational and commercial including catch and release.	**8.0**	x	x	36.4	49.0	50.0	x	47.1	58.8
Nurseries and other protected areas	Regulations in nurseries/protected areas	There should be no bass angling competitions in nursery/protected areas.	**7.3**	84.6	73.3	82.5	82.9	71.4	71.4	86.7	90.0
Nurseries and other protected areas	Regulations in nurseries/protected areas	Shore anglers should return any bass caught in a bass nursery area.	**6.6**	69.6	x	82.7	82.5	90.0	88.9	83.3	82.4

Table 10c: looking at only the percentage of people who agreed, the six statements from the ‘Nurseries and other protected areas’ category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was “c”

The three statements from the 'Regulation' category which show the strongest evidence of consensus between recreational and commercial fishers (Table 11a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	Regulation	Regulation strategy	Any fisher selling bass should automatically be classed as a commercial fisher and subject to commercial regulations.	Agreement with the statement	91.5	83.6	**87.5**
2	Regulation	Closed seasons, less strict	No closed season for bass.	Disagreement with the statement	92.3	74.0	**83.2**
3	Regulation	Bass size, minimum	Minimum bass landing size should be put back down to 36cms or 40cms - the size increase lead to many more smaller fish in rivers & lack of feed.	Disagreement with the statement	85.7	76.3	**81.0**

Table 11a: the three statements from the 'Regulation' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the 'Regulation' category which show the strongest evidence of <u>divergence</u> between recreational and commercial fishers (Table 11b)

Rank	Category	Sub-category	Statement	<u>Recreational</u> fishers that <u>agreed</u> (%)	<u>Commercial</u> fishers that <u>disagreed</u> (%)	Average % between the two groups	<u>Recreational</u> fishers that <u>disagreed</u> (%)	<u>Commercial</u> fishers that <u>agreed</u> (%)	Average % between the two groups
1	Regulation	Nets, mesh type/size	Mono gill nets are a menace to many forms of marine life and their use should be banned in UK waters. They are totally indiscriminate.	84.4	70.3	**77.3**			
2	Regulation	Regulation strategy, maintain/less strict	Commercial fisherman have already been severely regulated at their own cost over the past 2 years. There are already too many regulations.				80.2	72.3	**76.2**
3	Regulation	Nets, geographic regulations	All types of netting should be prohibited within one mile of the shore.	83.6	65.7	**74.6**			

Table 11b: the three statements from the 'Regulation' category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the ‘Regulation’ category showing the largest and smallest spread of opinion across the regions (Table 11c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
Regulation	Nets, drift and fixed	Drift netting for bass should be allowed.	**24.8**	52.0	37.9	13.1	8.5	0.0	60.0	x	x
Regulation	Nets, catch regulations	You should be able to target bass with gill nets instead of bass having to be a by-catch, whilst still sticking to a yearly catch limit.	**24.7**	47.8	26.9	16.7	23.4	x	70.0	0.0	x
Regulation	Closed seasons, maintain/stricter	Protection for spawning bass should be improved by a commercial and recreational closed season for retention of 4 months (1 Dec- 31 March).	**21.0**	x	33.3	57.6	63.3	x	87.5	x	78.9

The six statements from the ‘Regulation’ category showing the largest and smallest spread of opinion across the regions (cont) (Table 11c)

Regulation	Trawlers, banning	Ban supertrawlers from U.K. waters.	**6.2**	100.0	82.4	95.1	93.3	100.0	100.0	100.0	100.0
Regulation	Trawlers, banning	Super trawlers should be banned from fishing for bass.	**5.6**	93.8	84.2	91.5	97.7	100.0	100.0	100.0	92.3
Regulation	Perceptions of regulations	Management measures must be unambiguous and not open to different interpretations to facilitate enforcement.	**5.0**	80.0	76.2	80.8	76.6	88.9	x	84.2	87.5

Table 11c: looking at only the percentage of people who agreed, the six statements from the ‘Regulation’ category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was “c”

The three statements from the 'Science and evidence' category which show the strongest evidence of <u>consensus</u> between recreational and commercial fishers (Table 12a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	Science and evidence	Data collection	Accurate landings data is key to managing the stock sustainably for all stakeholders.	Agreement with the statement	92.0	79.5	**85.8**
2	Science and evidence	Research focus, stock levels and profile	Greater investment in understanding the stock status of bass nationally & regionally is required to ensure robust stock assessments.	Agreement with the statement	90.0	78.7	**84.3**
3	Science and evidence	Research focus, other	The food chain for bass needs scientific research, and action taken to preserve the food chain.	Agreement with the statement	88.2	75.0	**81.6**

Table 12a: the three statements from the 'Science and evidence' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the 'Science and evidence' category which show the strongest evidence of divergence between recreational and commercial fishers (Table 12b)

Rank	Category	Sub-category	Statement	Recreational fishers that agreed (%)	Commercial fishers that disagreed (%)	Average % between the two groups	Recreational fishers that disagreed (%)	Commercial fishers that agreed (%)	Average % between the two groups
1	Science and evidence	Research focus, socio-economics	The potential economic, social and ecological benefits of recreational bass angling over commercial fishing should be investigated.	89.8	56.0	**72.9**			
2	Science and evidence	Fishers' knowledge	Recreational sea angling does not have a significant impact on bass stocks.	59.1	84.5	**71.8**			
3	Science and evidence	Landings data, recreationals	Recreational anglers should have to submit their catches of bass daily so they can be better managed.				49.6	76.0	**62.8**

Table 12b: the three statements from the 'Science and evidence' category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the 'Science and evidence' category showing the largest and smallest spread of opinion across the regions (Table 12c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
Science and evidence	Research focus, socio-economics	The potential economic, social and ecological benefits of recreational bass angling over commercial fishing should be investigated.	**19.6**	30.4	57.7	68.9	67.0	80.0	50.0	89.5	x
Science and evidence	Research focus, stock levels and profile	We need to know how big the bass stock was before monofilament netting started, so we don't accept today's poor stock as being the norm.	**18.6**	x	50.0	x	63.7	50.0	x	94.1	75.0
Science and evidence	Fishers' knowledge	Anglers and commercial fishers are very protective of their knowledge about bass and full cooperation with researchers will be met with cynicism.	**17.5**	75.0	52.9	x	x	100.0	83.3	57.1	66.7

The six statements from the 'Science and evidence' category showing the largest and smallest spread of opinion across the regions (cont) (Table 12c)

Science and evidence	Research focus, stock levels and profile	Greater investment in understanding the stock status of bass nationally & regionally is required to ensure robust stock assessments.	**6.6**	91.3	90.9	84.6	84.2	100.0	x	100.0	87.5
Science and evidence	Importance of the science	The Bass FMP should be based much more on hard data than anecdotes.	**5.3**	77.3	86.4	80.8	77.6	80.0	x	73.7	88.9
Science and evidence	Landings data	Bass landings by our large fishing craft steaming and landing direct to European ports, (Spain mainly), be recorded to DEFRA and published.	**3.6**	x	81.0	83.3	86.8	80.0	x	88.2	x

Table 12c: looking at only the percentage of people who agreed, the six statements from the 'Science and evidence' category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was "c"

The three statements from the 'Stakeholder relationships' category which show the strongest evidence of consensus between recreational and commercial fishers (Table 13a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	Stakeholder relationships	Fishers, commercial <-> fishers, recreational	Commercial fishers and anglers should be able to agree that illegal netting of bass should be stopped.	Agreement with the statement	92.5	73.1	**82.8**
2	Stakeholder relationships	Fishers, commercial <-> fishers, recreational	Commercial and recreational fishers should work together to achieve a bass fishery which meets the needs and aspirations of both.	Agreement with the statement	91.1	70.5	**80.8**
3	Stakeholder relationships	Fishers, commercial <-> fishers, recreational	There should be a way for anglers and commercial fishers to work together as both want more and bigger bass in the sea.	Agreement with the statement	84.0	73.3	**78.7**

Table 13a: the three statements from the 'Stakeholder relationships' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the ‘Stakeholder relationships’ category which show the strongest evidence of <u>divergence</u> between recreational and commercial fishers (Table 13b)

Rank	Category	Sub-category	Statement	Recreational fishers that agreed (%)	Commercial fishers that disagreed (%)	Average % between the two groups	Recreational fishers that disagreed (%)	Commercial fishers that agreed (%)	Average % between the two groups
1	Stakeholder relationships	Fishers, commercial <-> fishers, recreational	Recreational anglers have no real knowledge of the commercial world.				75.0	84.0	**79.5**
2	Stakeholder relationships	DEFRA <-> fishers, recreational	Recreational fishers are currently treated as an annoyance, rather than an equal stakeholder.	85.3	68.7	**77.0**			
3	Stakeholder relationships	Fishers, rod and line <-> fishers, netters	Hook and line caught bass sell at a far higher price than gill netted fish . Netting devalues a high value resource for other stakeholders.	77.0	48.4	**62.7**			

Table 13b: the three statements from the ‘Stakeholder relationships’ category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the 'Stakeholder relationships' category showing the largest and smallest spread of opinion across the regions (Table 13c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
Stakeholder relationships	Fishers, commercial <-> fishers, recreational	There's no way to get commercial and recreational fishers to work together to create solutions which work for everyone.	**23.2**	37.5	48.1	23.8	x	x	60.0	0.0	x
Stakeholder relationships	Fishers, commercial <-> fishers, recreational	Recreational anglers have no real knowledge of the commercial world.	**17.2**	63.6	55.6	35.0	42.1	70.0	77.8	x	35.0
Stakeholder relationships	DEFRA <-> fishers, recreational	Recreational fishers are currently treated as an annoyance, rather than an equal stakeholder.	**15.7**	45.8	50.0	58.3	63.7	x	x	89.5	70.0

The six statements from the 'Stakeholder relationships' category showing the largest and smallest spread of opinion across the regions (cont) (Table 13c)

Stakeholder relationships	Fishers, commercial <-> fishers, recreational	We should all move away from anecdotal accusations and hearsay about recreational and commercial fishers.	**9.5**	86.7	80.0	76.6	75.9	88.9	83.3	100.0	100.0
Stakeholder relationships	Fishers, commercial <-> fishers, recreational	There should be a way for anglers and commercial fishers to work together as both want more and bigger bass in the sea.	**7.7**	76.2	91.3	81.1	83.5	100.0	x	84.2	88.2
Stakeholder relationships	Fishers, commercial <-> fishers, recreational	Commercial fishers and anglers should be able to agree that illegal netting of bass should be stopped.	**6.6**	86.4	82.6	89.1	84.6	90.9	77.8	100.0	90.0

Table 13c: looking at only the percentage of people who agreed, the six statements from the 'Stakeholder relationships' category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was "c"

The three statements from the 'Sustainability of the fishery' category which show the strongest evidence of consensus between recreational and commercial fishers (Table 14a)

Rank	Category	Sub-category	Statement	Type of consensus	Recreational fishers (%)	Commercial fishers (%)	Average % between the two groups
1	Sustainability of the fishery	Gear/methods	Unsustainable commercial fishing effort must be stopped.	Agreement with the statement	87.9	48.5	**68.2**
2	Sustainability of the fishery	Importance of sustainability	We urgently need to restore and give the bass stock the protection it needs to be healthy and viable for future generations.	Agreement with the statement	90.1	46.2	**68.2**
3	Sustainability of the fishery	Jobs and livelihoods	Commercial fishermen aren't the only ones whose livelihoods depend on the bass stock.	Agreement with the statement	92.7	40.4	**66.6**

Table 14a: the three statements from the 'Sustainability of the fishery' category which show the strongest evidence of consensus between recreational and commercial fishers

The three statements from the 'Sustainability of the fishery' category which show the strongest evidence of <u>divergence</u> between recreational and commercial fishers (Table 14b)

Rank	Category	Sub-category	Statement	Recreational fishers that agreed (%)	Commercial fishers that disagreed (%)	Average % between the two groups	Recreational fishers that disagreed (%)	Commercial fishers that agreed (%)	Average % between the two groups
1	Sustainability of the fishery	Jobs and livelihoods	Numerous tackle shops have closed as a direct result of poor fish stocks due in turn to commercial overfishing.	72.2	85.5	**78.8**			
2	Sustainability of the fishery	Gear/methods	Netting bass is the least sustainable method of capture and it should be phased out.	82.4	58.8	**70.6**			
3	Sustainability of the fishery	Jobs and livelihoods	Commercial fishermen aren't the only ones whose livelihoods depend on the bass stock.	92.7	41.5	**67.1**			

Table 14b: the three statements from the 'Sustainability of the fishery' category which show the strongest evidence of divergence between recreational and commercial fishers

The six statements from the 'Sustainability of the fishery' category showing the largest and smallest spread of opinion across the regions (Table 14c)

Category	Sub-category	Statement	Standard Deviation	East of England (inc East Midlands) (%)	South East (inc London) (%)	South (Hamps., Dorset) (%)	South West (%)	North East (inc Yorkshire) (%)	North West (%)	Wales, South (inc Bristol, Gloucs and Somerset) (%)	Wales, Mid & North (%)
Sustainability of the fishery	Gear/methods	Netting bass is the least sustainable method of capture and it should be phased out.	**18.1**	40.9	44.0	64.4	66.1	50.0	x	89.5	x
Sustainability of the fishery	Value of recreational fishing	The mental health benefits of angling ought to be more recognised - it reduces the load on the NHS.	**18.1**	50.0	x	58.6	58.9	x	60.0	100.0	76.2
Sustainability of the fishery	Jobs and livelihoods	"It's our livelihood" arguments from commercial fishers fail to consider the many businesses that rely on a healthy recreational fishery.	**16.9**	38.5	55.6	65.9	60.0	62.5	x	80.0	90.9

The six statements from the 'Sustainability of the fishery' category showing the largest and smallest spread of opinion across the regions (cont) (Table 14c)

Sustainability of the fishery	Importance of sustainability	Sustainability of the bass stock is in everyone's interest.	**9.9**	82.4	73.9	96.0	94.2	100.0	100.0	100.0	100.0
Sustainability of the fishery	Jobs and livelihoods	Bass guides will depend entirely on a healthy bass stock for a livelihood.	**9.7**	66.7	64.7	65.1	63.5	75.0	x	73.3	90.9
Sustainability of the fishery	Value of recreational fishing	Angling for bass is a great way to provide healthy and nutritious food for the family.	**2.5**	70.6	68.4	70.8	67.5	66.7	x	x	64.3

Table 14c: looking at only the percentage of people who agreed, the six statements from the 'Sustainability of the fishery' category showing the largest and smallest spread of opinion (as measured by the standard deviation) across the regions. High standard deviation = large spread. Low standard deviation = small spread. "x" means more than 20% of people from that group were pass/unsure or the %+ figure for that region was "c"

The number and percentage of statements per category which show possible evidence of consensus (Table 15)

Category	Total number of statements	Number of possible consensus statements	Percentage of statements which are possible consensus
Enforcement	105	38	36.2
By-catch and discards	24	7	29.2
Stakeholder relationships	36	8	22.2
Science and evidence	72	15	20.8
Nurseries and other protected areas	29	6	20.7
Markets and food supply	31	6	19.4
Authorisations and licences	74	13	17.6
Regulation	155	26	16.8
Management	147	19	12.9
Sustainability of the fishery	38	4	10.5
Total	**711**	**142**	**20.0**

Table 15: the number and percentage of statements per category which show possible evidence of consensus, ordered highest to lowest by percentage of statements which are possible consensus

Limitations of the Pol.is platform for conducting Collective Intelligence debates

Pol.is is a powerful tool for capturing the collective intelligence of large numbers of people in policy discussions, but it is important to be aware of its limitations, some of which are considered here:

- It is not clear from the data the reasons why a participant decided to pass a given statement. This could have been for a variety of reasons, for example because they didn't understand the statement, because they didn't feel they had enough information to cast a vote (such as an English fisher voting on a statement about Welsh issues) or because they wished to abstain.
- Similarly, the strength of agreement or disagreement is not clear from the data. Participants may agree strongly or only mildly with a statement, but can only opt to agree in each case. However, it is important to note that the binary choice is also a strength of the Pol.is process, as it encourages decisive voting.
- Policy Lab have endeavoured to either remove (through moderation) or simplify statements which contain multiple or complex ideas, to ensure consistency in participants' interpretations of the statements. However, it is still possible for different participants to interpret the same statement in different ways, or to agree/disagree with different parts of it.
- For a topic as complex and wide-reaching as bass fishing, the number of unique statements submitted by participants can be very large. This leads to a rich debate, but can also make the daily time commitment considerable for participants attempting to respond to each new statement. This could explain feedback which Policy Lab received from some participants that the debate was more time-consuming than had been advertised.

Definitions

Consensus - For a statement to be classed as showing possible evidence of consensus, it must meet either one of the following two conditions: 1) 40% of recreational fishers and 40% of commercial fishers agreed with a statement, and less than 20% of both groups passed; 2) 40% of recreational fishers and 40% of commercial fishers disagreed with a statement, and less than 20% of both groups passed. The low threshold of 40% was chosen in order to identify both clear and possible areas of consensus, for further exploration by DEFRA. Whichever condition is relevant, the relevant average of the percentages of both groups is shown in the data. The highest averages show the statements with strongest evidence of possible consensus.

Divergence - For a statement to be classed as showing possible evidence of divergence, it must meet either one of the following two conditions: 1) 40% of recreational fishers agreed and 40% of commercial fishers disagreed with a statement, and less than 20% of both groups passed; 2) 40% of recreational fishers disagreed and 40% of commercial fishers agreed with a statement, and less than 20% of both groups passed. Whichever condition is relevant, the relevant average of the percentages of both groups is shown in the data. The highest averages show the statements with strongest evidence of possible divergence.

Spread - Calculated on the percentage of people who agreed with a statement from different geographic regions. For a statement to be considered for analysis of spread across geographic regions, at least five out of the eight regions (excludes 'Other region') must present %? figures lower than 20% and/or %+ figures which are not "c". This is to ensure that the standard deviation is calculated using a large and robust number of figures. The formula used to calculate standard deviation is shown below.

$$s = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2}$$

Notes

a) Participants could identify with more than one stakeholder group/region/gear if relevant to them, and therefore would be counted in each group. For example, an individual might have indicated that they were both a recreational fisher and a charter vessel skipper, in which case they would be part of the counts for both recreational fishers and charter vessel skippers.

a) Percentages where fewer than five people voted are marked by "c" in the data, to ensure that only robust figures are presented for analysis and also to avoid any risk of participants being identifiable from the data.

a) A value of 0 is a “true zero” (nobody from a given demographic group voted in this way)

d) Because of the low threshold of 40% for identifying possible areas of consensus and divergence, it is possible for a statement to show possible evidence of both consensus and divergence.

e) The threshold of 20% used for pass figures is to ensure that only statements where a high proportion of participants felt comfortable enough to vote decisively are used in the analysis.

December 2022

POLICY LAB

Department for Environment Food & Rural Affairs

Co-design: a summary

Seabass Fisheries Management Plan 2023

Project Team

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This report contains unpublished data which has not yet been quality assured by an analyst.

POLICY LAB

Department for Environment Food & Rural Affairs

Overview

This is the co-design report, produced as part of the collaboration between the Department for Environment, Food and Rural Affairs (Defra), Welsh Government and Policy Lab on the Seabass FMP project that took place between April 2022 and December 2022.

This report provides a summary of approaches and key findings of the co-design process, which took place in the form of in-person and online workshops and an online survey in autumn 2022.

Policy Lab is a multidisciplinary team working openly and collaboratively across government, bringing expertise in policy, ethnography, systems thinking, futures and design.

We support the public sector to achieve better policy outcomes by partnering on innovative projects, leading and demonstrating best practice, and delivering training.

Since 2014, we have partnered with policy teams on over 200 projects, working with 7,000 public servants across central and local government departments and agencies, as well as internationally.

Policy Lab is multi-award winning, and one of the world's longest-standing government Labs dedicated to policy innovation.

Our projects test new approaches which bring lived experience and experimentation into policymaking. We share our new tools and techniques openly on our blog and the Open Policy Making Toolkit to encourage system-wide transformation.

Project Timeline

Evidence Discovery and Expert Interviews
(April - May '22)

Lived Experience Research
(June - August '22)

Collective Intelligence Debate
(August '22)

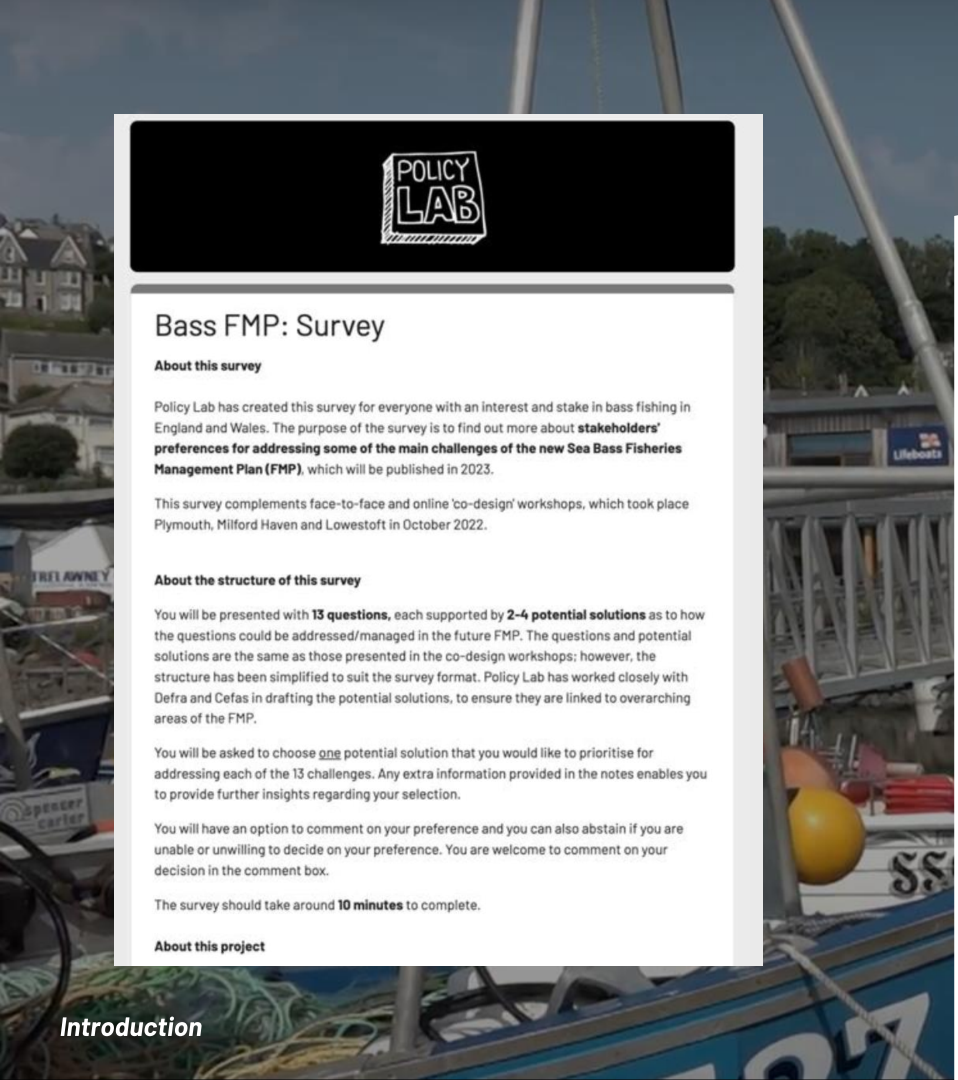
Co-Design
(September- November '22)

A combination of workshops and survey to form a sensible set of FMP solutions by working through challenges and potential solutions with stakeholders.

Co-Refine
(November - December '22)

Co-design workshop locations and stakeholders

- Policy Lab conducted five in-person workshops in three locations:
  - Plymouth, Devon
  - Milford Haven, Pembrokeshire
  - Lowestoft, Suffolk
- We also carried out four online workshops.
- In total, **72 external stakeholders** attended the workshops.



Bass FMP: Survey

About this survey

Policy Lab has created this survey for everyone with an interest and stake in bass fishing in England and Wales. The purpose of the survey is to find out more about **stakeholders' preferences for addressing some of the main challenges of the new Sea Bass Fisheries Management Plan (FMP)**, which will be published in 2023.

This survey complements face-to-face and online 'co-design' workshops, which took place Plymouth, Milford Haven and Lowestoft in October 2022.

About the structure of this survey

You will be presented with **13 questions,** each supported by **2-4 potential solutions** as to how the questions could be addressed/managed in the future FMP. The questions and potential solutions are the same as those presented in the co-design workshops; however, the structure has been simplified to suit the survey format. Policy Lab has worked closely with Defra and Cefas in drafting the potential solutions, to ensure they are linked to overarching areas of the FMP.

You will be asked to choose one potential solution that you would like to prioritise for addressing each of the 13 challenges. Any extra information provided in the notes enables you to provide further insights regarding your selection.

You will have an option to comment on your preference and you can also abstain if you are unable or unwilling to decide on your preference. You are welcome to comment on your decision in the comment box.

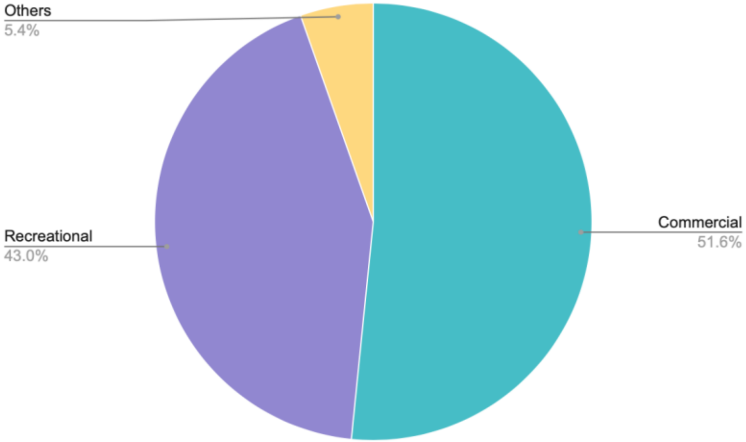
The survey should take around **10 minutes** to complete.

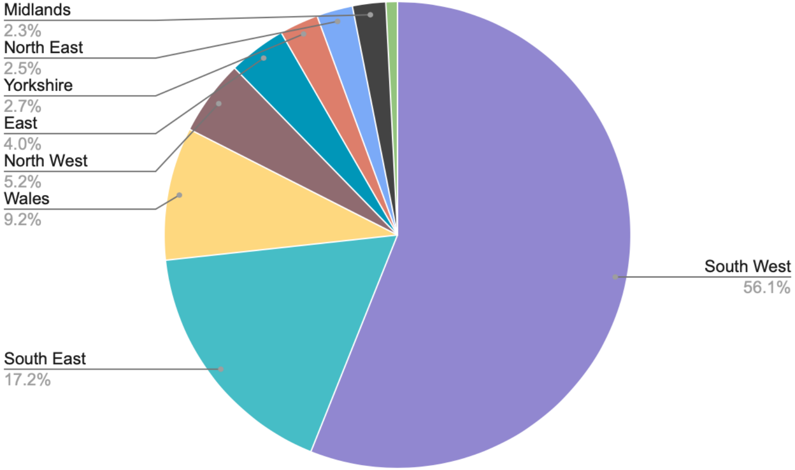
About this project

Online Co-design Survey

- All seabass stakeholders on Policy Lab's mailing list, all seabass licence holders, regional IFCAs, MMOs, environmental organisations and other key stakeholders were sent an online survey.
- The survey was based on the same scenarios that were played out in co-design workshops. Respondents were presented with 13 questions, each supported by 2-4 potential solutions on how the questions could be addressed in the future FMP.
- We received **477 responses**.

Co-design survey: participation





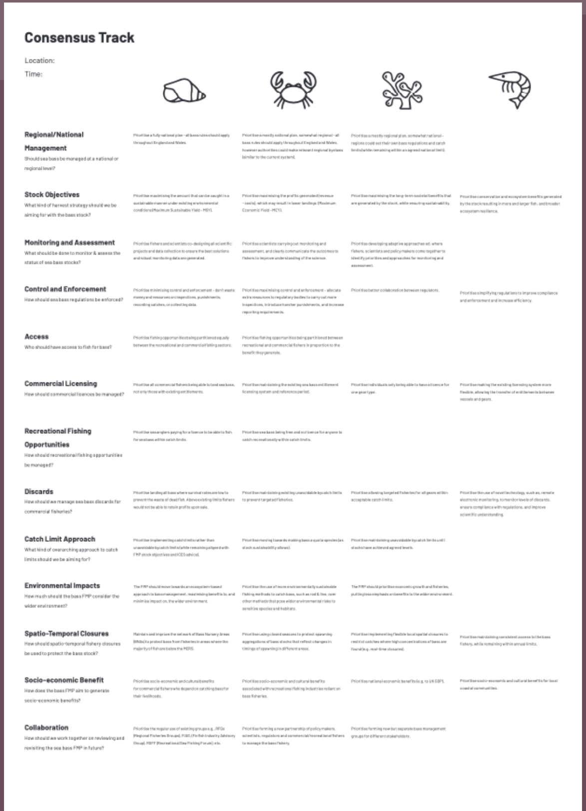
Methodology

- The purpose of the co-design process was to form a sensible set of FMP solutions by working through challenges and potential solutions with stakeholders.
- The challenges and solutions stemmed from the lived experience research, which took place in summer 2022 as well as the ‘collective intelligence’ debate, a nationwide online discussion, which took place in August 2022.
- Due to the amount of data from the lived experience and collective intelligence stages, it was essential to prioritise the areas of greatest interest and importance, whilst balancing the interests of different stakeholder groups. Not all issues that were raised in the research phase were discussed in detail in the co-design setting.
- All the content was discussed in great detail with Cefas and Defra to ensure that solutions proposed in the co-design process were feasible from a scientific and legal perspective.
- Due to a large number of expressions of interest, Policy Lab ran a computer randomisation process to select the participants. In some cases, we were unable to recruit enough participants through the randomised selection and had to approach individuals directly or via gatekeepers (e.g. fishing organisations etc).

A participant in one of the co-design workshops

Co-design workshops

- The co-design discussions were deliberately held with small groups to encourage in-depth discussions around the future FMP.
- Each session included representatives from a diverse range of seabass stakeholders: recreational fishers, commercial fishers, charter boat skipper/s, buyers/sellers, MMO, IFCA, eNGOs, scientists.
- The workshops involved practical scenario and idea testing, which identified areas of agreement and disagreement between stakeholders, as well as additional ideas for improving potential solutions.
- The in-person format was then replicated to work online with the same challenge questions


Consensus Track

Location:

Time:

Regional/National Management
Should sea bass be managed at a national or regional level?

Stock Objectives
What kind of harvest strategy should we be aiming for with the bass stock?

Monitoring and Assessment
What should be done to monitor & assess the status of sea bass stocks?

Control and Enforcement
How should sea bass regulations be enforced?

Access
Who should have access to fish for bass?

Commercial Licensing
How should commercial licences be managed?

Recreational Fishing Opportunities
How should recreational fishing opportunities be managed?

Discards
How should we manage sea bass discards for commercial fisheries?

Catch Limit Approach
What kind of overarching approach to catch limits should we be aiming for?

Environmental Impacts
How much should the bass FMP consider the wider environment?

Spatio-Temporal Closures
How should spatio-temporal fishery closures be used to protect the bass stock?

Socio-economic Benefit
How does the bass FMP aim to generate socio-economic benefits?

Collaboration
How should we work together on reviewing and revisiting the sea bass FMP in future?

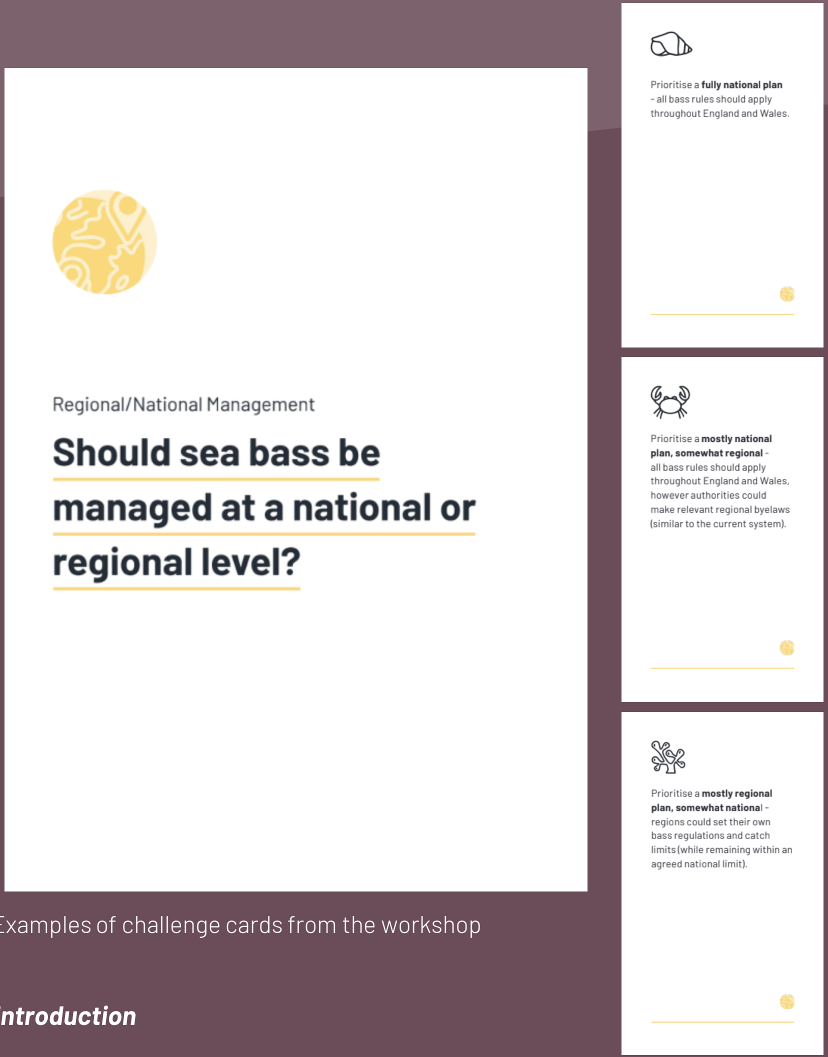
An example of a consensus tracker used in workshops

Scenario-based approach

- In order to test how different ideas would be received and could work in practice, Policy Lab design a practical approach based on scenario and idea testing.
- Participants engaged in discussions around 12-13 specific challenge questions, which were identified as top priority areas of concern by stakeholders during the previous research stages of the project.
- Participants were presented with 2-4 solutions to address these challenges; again, these solutions were proposed by stakeholders during the research phase of the project.
- Participants were invited to vote on their favourite solutions. They also engaged in a discussion, after which they had a chance to move their votes.
- Facilitators noted down participants' individual preferences as well as group's overall preferences. These were analysed and compared between the workshops and the survey.
- The survey replicated the same scenarios, thus allowing more stakeholders to feed in their views on the same challenge questions.

> *My view is they are doing a good job trying to condense a huge variety of opinions into max four options.*
> *I did genuinely find yesterday's meeting very enlightening.*
>
> Workshop participant

> *I haven't taken part in anything like that before. I found it very interesting and well organised and I felt that we were definitely listened to.*
>
> Workshop participant



Examples of challenge cards from the workshop

Challenges

The co-design process focused on the following challenges:

- Regional / national management
- Stock objectives
- Monitoring and assessment
- Control and enforcement
- Commercial licensing
- Recreational fishing opportunities
- Discards
- Catch limit approach
- Environmental impacts
- Spatial-temporal closures
- Socio-economic benefit
- Collaboration
- Access (online survey only)

Regional / national management

The first challenge area participants focused on was the regional versus national management of seabass fisheries. The challenge question for this topic was:

Should seabass be managed at a national or regional level?

The three solutions that the stakeholders were asked to comment on were:

- Prioritise a fully national plan - all seabass rules should apply throughout England and Wales.
- Prioritise a mostly national plan, somewhat regional - all seabass rules should apply throughout England and Wales, however authorities could make relevant regional byelaws (similar to the current system).
- Prioritise a mostly regional plan, somewhat national - regions could set their own seabass regulations and catch limits (while remaining within an agreed national limit).

Fully national plan

- One out of nine co-design workshop groups voted in favour of a fully national plan as a group consensus. This means that this was the least popular option across all workshops.
- This compares to 42.3% of survey respondents voting in favour of a fully national plan; this was by far the most popular potential solution in comparison to other options.

Mostly national, somewhat regional plan

- Four out of nine groups collectively voted in favour of a mostly national, somewhat regional plan, making this option the most popular potential solution across all nine workshops.
- However, one fourth (25.1%) of survey respondents chose this option as their preferred solution, making it the least popular option amongst the three potential solutions.

Mostly regional, somewhat national plan

- Three out of nine groups' consensus was on opting for a mostly regional, somewhat national plan, meaning that this was the second most popular option across all workshops.
- In comparison, 29.7% of survey respondents voted in favour of this option, making it the second most popular option.

Abstain

- Two groups' consensus was on abstaining on this question.
- In the online survey, 2.7% of all respondents chose not to respond to this question.

* the most supported options are coloured in pink.

Participants' comments

"National. Plain and simple. Nice and easy for everyone to follow."

"There should be a national plan to manage the seabass fishery but there should also be powers that allow regional bye laws to apply extra enforcement."

"With the biology of seabass, what might be happening on west coast of Wales might not be same as on the east coast of England."

Stock objectives

One of the challenge areas focused on the management of seabass stocks and harvest strategy for England and Wales, with the challenge question being:

What kind of harvest strategy should we be aiming for with the seabass stock?

Stakeholders were asked to prioritise one of the four potential solutions:

- Prioritise maximising the amount that can be caught in a sustainable manner under existing environmental conditions (Maximum Sustainable Yield - MSY).
- Prioritise maximising the profits generated (revenue - costs), which may result in lower landings (Maximum Economic Yield - MEY).
- Prioritise maximising the long-term societal benefits that are generated by the stock, while ensuring sustainability.
- Prioritise conservation and ecosystem benefits generated by the stock resulting in more and larger fish, and broader ecosystem resilience.

Maximising the amount that can be caught in a sustainable manner

- One out of nine workshop groups' consensus was on prioritising maximum sustainable yield as their preferred option for managing seabass stock levels.
- This compares to roughly one third of all survey respondents (34.5%) voting in favour of this approach – joint preferred option with prioritising conservation and ecosystem benefits.
- This option was significantly more popular with commercial fishers (60%) than their recreational counterparts (5.4%)

Conservation and ecosystem benefits

- Two out of nine groups collectively voted in favour of prioritising conservation and ecosystem benefits, making this the second most popular option across the nine workshops.
- This potential solution was jointly the most popular option by survey respondents. More than one third of all respondents (34.5%) opted for this answer.
- Whilst this option was favoured by 63.4% of recreational respondents, it attracted little support (10%) from commercial fishers.

Maximising the long-term societal benefits

- This option was the most popular potential solution across the workshops, with six out of nine workshop groups voting in favour of this option.
- However, this option was less popular by survey respondents, with less than one fifth (18.5%) of stakeholders choosing it as their priority.

Maximising the profits generated

- None of the workshop groups voted collectively in favour of maximising the profits generated.
- In comparison, 7.5% of survey respondents voted for prioritising this potential solution, making it the least popular option.

Abstain

- One out of nine groups abstained and did not collectively choose any of the four potential solutions.
- 5% of survey respondents chose not to answer to this question

* the most supported options are coloured in pink.

Participants' comments

"Fish are part of our natural capital. As a matter principle, they should be exploited to benefit most in society."

"I put MSY as my top priority- that is not easy to define and meet but if you can get that right you stand a good chance of having a sustainable fishery."

"Prioritise conservation and ecosystem benefits generated by the stock results in larger fish and broader ecosystem resilience."

Voting in progress in one of the in-person workshops

Monitoring and assessment

The challenge question in the area of monitoring and assessment was:

What should be done to monitor and assess the status of seabass stocks?

There were three potential solutions for stakeholders to choose from. These were:

- **Prioritise fishers and scientists co-designing all scientific projects and data collection to ensure the best solutions and robust monitoring data are generated.**
- **Prioritise scientists carrying out monitoring and assessment, and clearly communicate the outcomes to fishers to improve understanding of the science.**
- **Prioritise adaptive approaches being developed, where fishers, scientists and policy makers come together to identify priorities and strategies for monitoring and assessment, responding to new opportunities and updating the FMP in the context of ICES advice.**

Fishers and scientists co-designing all scientific projects and data collection

- Whilst this option was discussed favourably in the workshop groups, none of the groups voted for this option as their group priority.
- In contrast, one fourth (24.4%) of all survey respondents opted for this potential solution as their preference.

Adaptive approaches

- All nine co-design workshop groups' consensus was in favour of adaptive approaches, thus making this option a firm winning solution.
- Similarly, this option was popular by survey respondents. 58.1% of those surveyed favoured this approach as their priority.

Scientists carrying out monitoring and assessment

- None of the nine groups voted for this option as their priority.
- In the survey, 11.8% of respondents said that this was their favourite potential solution for addressing the question of monitoring and assessing seabass stocks.

Abstain

- None of the nine workshop groups abstained on this question.
- In the survey, 5.5% of the respondents did not wish to answer this question.

* the most supported options are coloured in pink.

Participants' comments

"Scientists alone cannot do this; there needs to be significant input from interested third parties."

"Good to get everyone involved and engaged in process from the outset to get what we were all aiming for."

"So many times we've seen scientific advice being ignored/comes out of the political sausage machine differently. [...]"

Control and enforcement

Stakeholders discussed the best way forward for controlling and enforcing seabass regulation by reflecting on the following challenge question:

How should seabass regulations be enforced?

Stakeholders were choosing between four potential solutions for addressing this challenge area:

- Prioritise minimising control and enforcement - don't waste money and resources on inspections, punishments, recording catches, or collecting data.
- Prioritise maximising control and enforcement - allocate extra resources to regulatory bodies to carry out more inspections, introduce harsher punishments, and increase reporting requirements.
- Prioritise better collaboration between regulators.
- Prioritise simplifying regulations to improve compliance and enforcement and increase efficiency.

Minimising control and enforcement

- Workshop participants were not collectively in favour of minimising the current control and enforcement levels with none of the groups opting for this option as their priority.
- Similarly, only 4.2% of survey respondents opted for this option as their preferred potential solution.

Maximising control and enforcement

- Three out of nine co-design workshops' consensus was on voting for this option as their favourite potential solution for addressing the challenge question, making this the second most popular approach.
- Similarly, this was the second favourite priority by the survey respondents with 40.2% voting in favour of this approach.

Better collaboration between regulators

- One out of nine groups voted for this option as their favourite solution.
- In the survey, 7.4% of respondents voted for this approach as their priority.

Simplifying regulations

- Six out of nine co-design workshop groups voted for this option as their favourite potential solution, making this approach the most popular one.
- Similarly, this approach was favoured by the most survey respondents with 44.2% opting to vote for his solution.

Abstain

- None of the nine groups abstained on this question.
- In the survey, 3.8% of respondents abstained.

* the most supported options are coloured in pink.

Participants' Comments

"If we could simplify the rules, we could have more effective policing and get better data."

"Regulators often do not understand as well as fishers. As someone whose job it is to enforce the regulations, I have to admit even I'm struggling to understand them now, it's getting so complicated."

"I would like simplification; rules currently are too complicated. Once that happens people will be able to do the right thing."

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Commercial licensing

Stakeholders reflected on the licensing regime for commercial seabass fishing by addressing the following challenge question:

How should commercial licences be managed?

There were four potential solutions for stakeholders to comment on and vote for:

- Prioritise all commercial fishers being able to land seabass, not only those with existing entitlements.
- Prioritise maintaining the existing seabass entitlement licensing system and reference period.
- Prioritise individuals only being able to have a licence for one gear type.
- Prioritise making the existing licensing system more flexible, allowing the transfer of entitlements between vessels and gears.

All commercial fishers being able to land seabass

- One out of nine workshop groups opted for the option of allowing all commercial fishers to land seabass as their priority.
- In the survey, 17.7% of all respondents favoured this approach as their priority solution.

Maintaining the existing seabass entitlement

- One out of nine workshop groups favoured the existing approach towards commercial licensing.
- This potential solution was the most voted for approach in the survey, with one third of respondents (33.5%) wishing to maintain the current licensing regime as their priority.

Only being able to have a licence for one gear type

- None of the nine co-design workshop groups favoured this approach as their collective priority.
- This compares to one fifth of survey respondents (20.4%) who opted for voting to have a licence for only one gear type as their overall priority.

Making the existing licensing system more flexible

- Two out of nine groups in co-design workshops collectively voted in favour of making the existing regime more flexible, making this the second most popular potential solution.
- This compares to 17.7% of survey respondents who voted for this option as their priority.

Abstain

- In co-design workshops, participants were struggling to choose between the best approach towards improving the current licensing system. This is reflected in the results; six out of nine groups abstained from choose between the four priorities.
- In the survey, 11.6% of respondents decided not to answer this question.

* the most supported options are coloured in pink.

Participants’ comments

“Youngsters find it hard to enter the seabass fishery because they can’t afford the increased cost of vessels with a seabass authorisation.”

“With the little knowledge I have, the current system seems broken. People should not be able to sell entitlements, a vessel should not hold more than one gear type - how can we ensure supposedly line caught fish are line caught if a vessel can use nets? [...]”

“There is already adequate measures in place, and I feel [there’s] enough pressure placed on fishermen.”

A participant considering his options in one of the co-design workshops

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Department for Environment Food & Rural Affairs

Recreational fishing opportunities

takeholders were asked to reflect on the following challenge question relating to the future f recreational fishing:

ow should recreational fishing opportunities be managed?

takeholders were choosing between two potential solutions:

- Prioritise sea anglers paying for a licence to be able to fish for seabass within catch limits.
- Prioritise seabass being free and no licence for anyone to catch recreationally within catch limits.

Sea anglers paying for a licence

- Three out of nine groups voted for the option of introducing compulsory licences for recreational seabass fishing.
- In the survey, 42.1% of all respondents voted in favour of this approach. The support was greater amongst the commercial sector, with 59.7% supporting this option in a sharp contrast to 20.4% of recreational fishers.

Abstain

- Two out of nine workshop groups voted in favour of abstaining from this question.
- In the survey, 5.5% of respondents decided not to answer this challenge question.

Seabass being free, without a licence

- Four out of nine workshop groups opted for this option as their collective consensus.
- More than half of all survey respondents (52.4%) said that their preference would be to maintain the current system of not needing a licence for recreational sea angling. The preference to maintain the status quo was greater amongst recreational fishers (76.2% versus 33% of commercial fishers).

* the most supported options are coloured in pink.

Participants’ comments

“Licensing will put people off, which is why the conversation around how the money is used is so important.”

“It’s a difficult one - I’ve previously worked with kids from disadvantaged backgrounds and fishing was my route into marine biology, the same for a lot of anglers too- seabass is a sport fish, if the cost of a rod license was a barrier to entry for communities in Pembrokeshire it would be a shame.”

“Recreational seabass fishing should be free for all, and in a well-managed fishery there would be plenty of seabass for all anglers.”

Discards

Stakeholders were discussing the issue of managing discards of seabass. The question for this challenge area was:

How should we manage seabass discards for commercial fisheries?

There were four potential solutions for stakeholders to reflect on and choose from:

- **Prioritise landing all seabass where survival rates are low to prevent the waste of dead fish. Above existing limits fishers would not be able to retain profits upon sale.**
- **Prioritise maintaining existing unavoidable bycatch limits to prevent targeted fisheries.**
- **Prioritise allowing targeted fisheries for all gears within acceptable catch limits.**
- **Prioritise the use of novel technology, such as, remote electronic monitoring, to monitor levels of discards, ensure compliance with regulations, and improve scientific understanding.**

Landing all seabass where survival rates are low to prevent the waste of dead fish

- Two out of nine co-design workshop groups opted for the approach of landing all seabass as their collective priority.
- This approach was the most popular option in the survey with almost one third of respondents (29.6%) choosing this option as their favourite potential solution for addressing the challenge of discards.

Maintaining the existing unavoidable bycatch limits

- Co-design workshop groups recognised the problems with the existing bycatch limits regime; only one group voted for this option as their collective priority.
- This compares to 18.4% of survey respondents saying that this was their favoured approach towards managing discards.

Allowing targeted fisheries for all gears

- This was the least favoured approach in co-design workshops, with none of the nine groups opting for this approach.
- In the survey, 19.7% of respondents opted for this option as their priority.

Prioritise the use of novel technology

- Prioritising the use of novel technologies for managing discards was deemed the best option by four out of nine co-design workshop groups, making this approach the most popular one in the workshop setting.
- This compares to 22.5% of survey respondents who voted in favour of this approach – the second most preferred option.

Abstain

- Two out of the nine groups abstained on this question.
- 9.6% of all respondents in the survey decided to abstain from answering this question.

* the most supported options are coloured in pink.

Participants' comments

"I don't know how this would work in practice but if it meant that all catches and discards were accurately monitored it sounds like a good idea."

"The use of novel technology has merits, I understand that 95% of discards are juvenile seabass and it is essential that if all are landed, it does not encourage commercial fishermen to continue targeting areas where juvenile seabass are, or for them to exceed their catch allowance."

"Use the Icelandic method. Land all seabass and sell those above the catch limit at auction giving fishers a 10% handling fee. Like with everything else, proper enforcement is required."

Catch limits approach

Stakeholders were asked to share their views on the future approach to managing catch limits. The challenge question was as follows:

What kind of overarching approach to catch limits should we be aiming for?

Stakeholders were choosing between three potential solutions:

- **Prioritise implementing catch limits rather than unavoidable bycatch limits (while remaining aligned with FMP stock objectives and ICES advice).**
- **Prioritise moving towards making seabass a quota species (as stock sustainability allows).**
- **Prioritise maintaining unavoidable bycatch limits until stocks have achieved agreed levels.**

Implementing catch limits rather than unavoidable bycatch

- This was by far the most popular option in co-design workshops and in the survey alike.
- Six out of nine workshop groups opted for the option of implementing catch limits as their collective priority.
- This was reflected in the survey, with 44.8% of respondents favouring this approach.

Maintaining unavoidable catch limits

- One out of nine workshop groups collectively voted for maintaining the current system of unavoidable bycatch limits for commercial seabass fishing.
- This compares to 21.1% of survey respondents opting for this approach as their priority.

Moving towards making seabass a quota species

- This approach was not popular in co-design workshops, with none of the nine groups opting for this option as their collective priority.
- Making seabass a quota species was the second most preferred option in the survey, with 21.9% of respondents voting in favour of this approach.

Abstain

- Three out of nine groups in co-design workshops decided to abstain.
- In the survey, 12% of all survey respondents did not wish to answer this challenge question.

* the most supported options are coloured in pink.

Participants' comments

"Catch limits are better than quota. As soon as you have quota, it becomes a commodity, then people start to abuse the system."

"Unavoidable [catch is] too vague. Catch limits could be the total amount of fish that can be removed from the fishery. [It's] important to identify allocations – what are the most sustainable methods and what can achieve max yield."

"If [unavoidable bycatch] was clarified, I'd go for maintaining bycatch limits."

Environmental impacts

Stakeholders were asked about the seabass FMP’s role for protecting the wider environment. The challenge question for this area was:

How much should the seabass FMP consider the wider environment?

Stakeholders were asked to prioritise between three potential approaches:

- The FMP should move towards an ecosystem-based approach to seabass management, maximising benefits to, and minimising impact on, the wider environment.
- Prioritise the use of more environmentally sustainable fishing methods to catch seabass, such as rod & line, over other methods that pose wider environmental risks to sensitive species and habitats.
- The FMP should prioritise economic growth and fisheries, putting less emphasis on benefits to the wider environment.

Ecosystem-based approach to seabass management

- This option was the second most favoured approach in the co-design workshops and the survey alike.
- Two out of nine workshop groups voted in favour of this approach.
- This compares to 19.6% of survey respondents who favoured this potential solution.

Prioritise economic growth and fisheries

- The option of prioritising economic growth was not favoured by any co-design workshop groups.
- In the survey, 10.3% of respondents opted for this potential solution as their priority.

Use of more environmentally sustainable fishing methods

- The approach of prioritising the use of more sustainable fishing methods to minimise the impact of seabass fishing on the environment was the most popular option.
- In co-design workshops, six out of nine groups opted for this potential solution as a group consensus
- In the survey, 61.1% of all respondents said that this was their favoured approach.

Abstain

- One out of nine co-design workshops decided to abstain.
- 9% of survey respondents decided not to vote for any of the three potential solutions and abstained.

* the most supported options are coloured in pink.

Participants' comments

"I think that sustainable methods should be prioritised such as hook and line, but other methods should have an allowance. The issue with other methods such as netting is not the method itself but the sheer amount of it that is going on, it is way too much and certain areas which are known to be seabass gathering areas should have a netting ban put in place."

" [...] We need to draw back to the context of this challenge which is risk from bass fishing to wider environment. Only using rod and line, you'd have minimal impact on environment. [...] Rod and line poses such minimal risk to wider environment - that is simplest way to do it."

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Spatial-temporal closures

Stakeholders were reflecting on the use of spatial-temporal closures to protect the seabass stock in England and Wales. The question for this challenge area was:

How should spatial-temporal fishery closures be used to protect the seabass stock?

There were four different options for stakeholders to prioritise and comment on:

- Maintain and improve the network of Bass Nursery Areas (BNAs) to protect seabass from fisheries in areas where the majority of fish are below the MCRS (Minimum Conservation Reference Size).
- Prioritise using closed seasons to protect spawning aggregations of seabass stocks that reflect changes in timings of spawning in different areas.
- Prioritise implementing flexible local spatial closures to restrict catches where high concentrations of seabass are found, e.g. RTC (real-time closures, closed to fishing for a limited period, triggered by information).
- Prioritise maintaining consistent access to the seabass fishery, while remaining within annual limits.

Maintain and improve the network of Bass Nursery Areas

- Maintaining and improving the network of existing nursery areas was favoured by three out of nine workshop groups.
- This was the second most favoured approach in the survey, with a quarter of all participants (25.1%) opting for this potential solution.

Closed seasons to protect spawning aggregations of seabass stocks

- This was the most popular approach, favoured by workshop participants as well as survey respondents.
- In co-design workshops, five out of nine groups voted in favour of this potential solution.
- In the survey, 40.6% of all respondents said that the closed seasons approach was their preferred way forward for reducing environmental impact of seabass fisheries.

* the most supported options are coloured in pink.

Flexible local spatial closures to restrict catches

- The option of flexible spatial closures was favoured by three out of nine workshop groups.
- This compares to only 12.8% of survey respondents, making this approach the least popular option in the survey.

Consistent access to the seabass fishery

- One out of nine groups in co-design workshops favoured this approach, making it the least popular option.
- In the survey, 16.6% of respondents said that having consistent access to seabass fishing was their preferred option.

Abstain

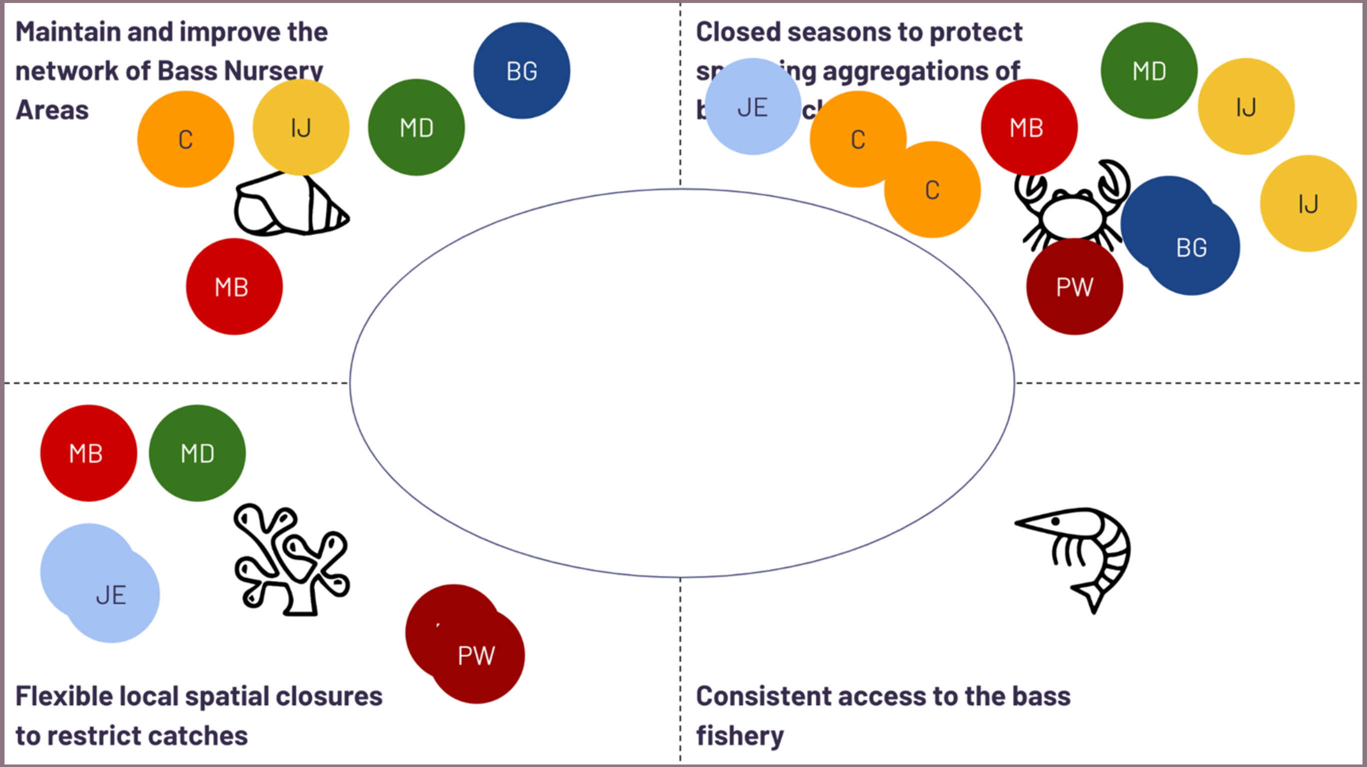
- One out of nine co-design workshops decided to abstain.
- In the survey, 4.6% of respondents opted not to respond to this question.

Participants' comments

“A multi-layered approach sounds right, it's important to target different cycles of seabass.”

"There needs to be better regulation around the big aggregations that occur sometimes.”

“[Closed seasons] would need to be managed regionally not nationally.”



An example of the voting board from the online workshops

Socio-economic benefits

Stakeholders shared their views on the socio-economic benefits of seabass fishing. The challenge question was:

How does the seabass FMP aim to generate socio-economic benefits?

Stakeholders were asked to choose between four potential solutions:

- Prioritise socio-economic and cultural benefits for commercial fishers who depend on catching seabass for their livelihoods.
- Prioritise socio-economic and cultural benefits associated with recreational fishing industries reliant on seabass fisheries.
- Prioritise national economic benefits (e.g. to UK GDP).
- Prioritise socio-economic and cultural benefits for local coastal communities.

Prioritise socio-economic benefits for commercial fishers

- The approach of prioritising the benefits for commercial fishers was favoured in one co-design workshop.
- In contrast, this option received the largest support in the online survey, with well over one third of all respondents (38.8%) voting for this approach.

Prioritise socio-economic benefits for recreational fishers

- This approach got little traction in co-design workshops, with none of the nine groups collectively voting for this option.
- However, 21.3% of survey respondents opted for this option as their priority.

Prioritise national economic benefit

- This was the least favoured option in co-design workshops and the survey alike.
- None of the nine workshops opted for this approach.
- This is consistent with the survey results, whereby only 3.1% of all respondents favoured this potential solution.

Prioritise local coastal communities

- Prioritising the benefits for local coastal communities was by far the most popular approach in co-design workshops, with seven out of nine workshops voting in favour of this priority.
- This approach was popular in the survey as well, where 29.1% of respondents favoured this option.

Abstain

- Two out of nine workshops abstained on this question.
- 8% of survey respondents opted out from responding to this question.

* the most supported options are coloured in pink.

Participants’ comments

“I don’t think we should choose one sector over another and we should think about benefits to local communities, which are the most deprived in the country.”

"Commercial fishermen NEED to be able to catch seabass to survive. The only realistic benefit to the UK economy is the landing of seabass, which is then sold to the food industries, which in turn pay taxes at every step.”

“I don’t like divisive options; we need to come together. If you go for local communities, you contribute to national economic growth and everything.”

Collaboration

Stakeholders were asked to think about how the sector can come together to collaborate on reviewing the seabass FMP in the future by addressing the following question:

How should we work together on reviewing and revisiting the seabass FMP in future?

Stakeholders were asked to prioritise the three potential solutions:

- Prioritise the regular use of existing groups e.g., RFGs (Regional Fisheries Groups), FIAG (Finfish Industry Advisory Group), RSFF (Recreational Sea Fishing Forum), etc.
- Prioritise forming a new partnership of policy makers, scientists, regulators and commercial/recreational fishers to manage the seabass fishery.
- Prioritise forming new but separate seabass management groups for different stakeholders.

Regular use of existing groups

- One out of nine workshop groups voted in favour of using the existing groups for future revisions of the seabass FMP.
- This compares to 17.7% of survey respondents who also favoured this approach over others.

Forming new but sector-specific seabass management groups

- Working on seabass FMP revisions in the sector silos was not a popular option in co-design workshops, with none of the groups voting in favour of this approach.
- Only 12.8% of survey respondents voted for this option, making it the least popular approach of the three.

Forming a new partnership of policy makers, scientists, regulators and fishers

- This option was the most popular approach across the board.
- Six out of nine co-design workshop groups opted for this approach as their group priority, making it by far the most favoured potential solution.
- Similarly, the survey showed that 60.8% of respondents expressed their preference for this approach.

Abstain

- One out of nine groups collectively voted for abstaining.
- In the survey, 8.4% of those surveyed said they wanted to abstain on this challenge question.

* the most supported options are coloured in pink.

Participants’ comments

“Work from the bottom-up. Bring the experts together, including fishers.”

“Networking, knowing who to invite, who to participate with - at the moment that is fragmented. The aim is to try to be inclusive with all stakeholders’ equal input [...] I do think some existing groups could be a springboard. Maybe we can evolve from there.”

“Agree with bringing people together and not discussing [seabass fishing] in silos.”

Access

Stakeholders were asked to reflect on the following challenge question relating to the topic of access to seabass:

Who should have access to fish for seabass?

Stakeholders were asked to choose between two potential solutions:

- **Prioritise fishing opportunities being partitioned equally between the recreational and commercial fishing sectors.**
- **Prioritise fishing opportunities being partitioned between recreational and commercial fishers in proportion to the benefit they generate.**

<u>**Due to time constraints, this question was only included in the online co-design survey and not discussed in the co-design workshops.**</u>

Partitioned equally between recreational and commercial fisheries

- 30.4% of those survey said that equal access to bass fishing was their preferred approach.

Abstain

- 21.7% of survey respondents abstained from answering this question.

Prioritise fishing opportunities being partitioned between recreational and commercial fishers in proportion to the benefit they generate.

- The majority of respondents, 47.9%, favoured this approach. However, in the comments it was evident that there are different definitions of 'the benefit' ranging from financial benefits and taxes paid by commercial fishers to the wellbeing benefits of sport seabass angling.

* the most supported options are coloured in pink.

Participants' comments

"This depends what benefits you take into account. I believe that this natural resource belongs to everybody."

"Recognise that 'benefit' includes mental and physical wellbeing of sport angling as well as financial benefit. Seabass are a resource to be enjoyed, not just money with fins."

"Commercial fishing should not cease, but management within a new Seabass FMP should prioritise the restoration of the seabass stock to where more and bigger seabass are once again available to the average angler, which will encourage spending and job creation in coastal communities."

How we used the co-design outcomes

- The co-design process, encompassing co-design workshops and a nation-wide online survey, brought together over 500 stakeholders, thus providing a strong basis for testing some of the ideas, solutions and suggestions that emerged from the lived experience research and the Collective Intelligence debate.
- Policy Lab analysed the outcomes of the survey and the workshops to understand the areas of consensus and divergence. As it is evident in this report, in some cases, the areas of consensus were clear; in other instances, different stakeholder groups had differing, or even conflicting, views.
- We discussed the outcomes of the co-design process with a group of government officials and arms-length bodies (IFCA, MMO, Natural England, Cefas etc), who have direct policy involvement and expertise on seabass fishing. This helped us to further test the feasibility of the solutions and explore what additional steps could be taken to refine the solutions without a clear stakeholder agreement.
- On the basis of these conversations and while liaising closely with representatives from Defra, Welsh Government and Cefas, Policy Lab formed 14 recommendations for the new FMP.
- These were further tested with a wide group of stakeholders in a ‘co-refine’ survey. We were looking for practical suggestions on how to make the solutions work for different stakeholder groups.
- The outcomes of the co-refine process, as well as the data from the co-refine survey, has been passed on to Defra for further consideration ahead of the public consultation in 2023.

Department for Environment Food & Rural Affairs

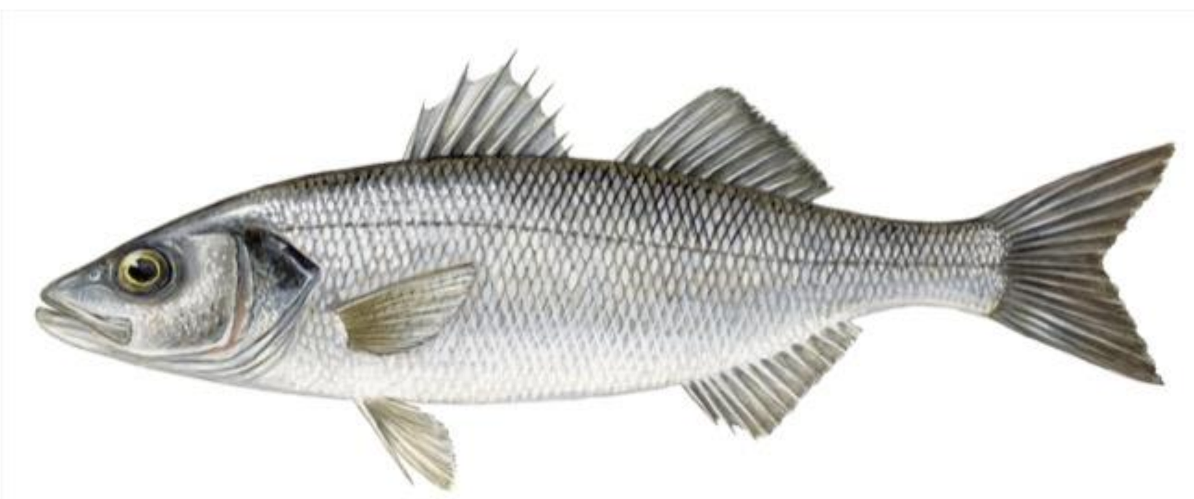
Llywodraeth Cymru
Welsh Government

Proposed Fisheries Management Plan for Sea bass in English and Welsh Waters

Annex 9: SNCB advice on wider environmental considerations

Date: July 2023

Version: public consultation



Contents

NE/JNCC Advice

All Fishery Management Plans are subject to legal and environmental obligations arising from the Habitats Regulations, Marine and Coastal Access Act, UK Marine Strategy, and the Environmental Principles policy statement for the Environment Act 2021.

Defra sought advice from the Joint Nature Conservation Committee (JNCC) and Natural England on the potential risk posed by the bass fisheries to the features in MPAs. JNCC and Natural England were also commissioned to provide advice on whether bass fisheries are likely to affect any of the UK Marine Strategy (UKMS) descriptors and our ability to achieve the targets for GES.

Risks and impacts arising from bass fisheries to the designated interest features of Marine Protected Areas (MPAs).

The breakdown of gear considered was based on analysis of bass landings between 2016 – 2020. 55% from hook and line, 33% from gillnets with a small amount from other demersal gears. Regulations around bass fishing are complex[2]. Bass can be caught and landed commercially with rod and line, fixed nets and demersal trawls. However, fishing for bass is also heavily regulated and is completely prohibited in some areas[3]. Fixed net and demersal trawl fishery catch limits are set to allow for bycatch.

Lack of good quality bycatch data, including what may be occurring at a fine scale / local level, severely restricts the ability to draw firm conclusions on mobile MPA features beyond site boundaries.

Summary of key issues

The below summarises the principal issues of concern that remain following detailed analysis. They are all related to netting.

Salmon in SACs in south and west

There is a risk of bycatch from netting at levels that could be significant for individual sites. Lack of usable data on salmon bycatch rates means a quantitative assessment is not possible. However, there is existing management (IFCA netting byelaws) that somewhat reduces the risk of bycatch. Current national restrictions on bass netting will further reduce the risk. However, those measures are designed to enable bass recovery and may be subject to change. More data are required on activity (For example, through iVMS) and levels of bycatch (For example, through targeted bycatch monitoring and / or reporting) to provide more robust evidence on risk.

Shad (allis and twaite) in SACs in south-west

There is evidence showing bycatch from netting does occur, but more data are required to quantify and understand the scale. Existing management from IFCA netting byelaws is likely to mitigate some of the risk. Current national restrictions on bass netting will also reduce the risk. However, those measures are designed to enable bass recovery and may be subject to change. More data are required on levels of bycatch (For example through bycatch monitoring and / or reporting) and activity (For example through iVMS) to understand the scale of the issue.

Seabirds (multiple species and SPAs across the UK)

Gillnets are known to pose a significant risk of bycatch of certain bird species. There are a lack of a good data sets to allow estimates of bird bycatch in nets with any degree of confidence. However, preliminary estimates suggest it could be of a scale that is having population level effects for *some* bird species that are features of SPAs. Large foraging ranges for some species and movements outside the breeding season means bycatch occurring remotely from the SPA may have a significant effect on classified bird features. Methods exist to investigate the relative significance of mortality outside of sites (and are used in offshore wind casework) but the lack of good bycatch data at a suitable resolution prevents such an assessment for fisheries. Work is ongoing to identify UK seabird bycatch hotspots but it is not yet available to inform the current advice. Better data are required on levels of seabird bycatch. Developing existing programmes such as the UK bycatch monitoring programme could contribute to resolving the issue. Additional data gathered through remote monitoring (REM) or self-reporting may also assist here. This will increase understanding to allow decisions on what and where mitigation may be required.

Harbour Porpoise in southern SACs

Gillnets targeting bass pose a risk to harbour porpoise and mortality is occurring at levels above precautionary thresholds in some management units. Assessing the impact of bycatch occurring outside the site boundary on the conservation objectives of the site is complex. Existing MPA management work (For example , Stage 4 of MMO byelaw process) will address site-level bycatch. There is also ongoing work focusing on understanding and mitigating the impact of bycatch on the wider population being progressed through Defra's Marine wildlife bycatch mitigation initiative (BMI) and the Clean Catch UK programme, however an action plan to deliver the BMI has not yet been published. Together these should ensure SAC conservation objectives are met. Building the evidence base through self-reporting of bycatch events will help support this assessment.

Bycatch risk to fish MPA features (outside of sites) from netting for bass

When using gillnets, there is the potential to catch other fish species as well as bass. Some of these may be species that are mobile features of MPAs or other protected sites. There are five fish species that are designated features of SACs that spend part of their lifecycle in coastal and marine waters (Atlantic salmon, allis shad, twaite shad, river lamprey and sea lamprey) and the five MCZ fish species (Long snouted seahorse, short snouted seahorse, giant goby, couch's goby and smelt), were considered. Based on the limited data available, netting is only thought to pose a significant risk to Atlantic salmon and the two shad species. For the remainder, there does not appear to be much inherent risk although that may be due in part to a lack of data.

Atlantic salmon

The risk that static nets can pose to Atlantic salmon is well known. For example, preliminary data from the Salmonid Management Around the Channel (SAMARCH) project found 11 salmon were caught in three 200m long gillnets off southern Cornwall (Environment Agency 2021). Waugh (2004) reported drift and static nets to be the most common method used by illegal poachers to capture salmon in the Thames Estuary.

There are 35 SACs in the UK with Atlantic salmon as a qualifying feature. Of these, seven are in England with three additional cross border sites. Although these are all freshwater SACs, as salmon spend a significant part of their life-cycle in the marine environment, they are potentially at risk from fisheries that operate in those geographic parts of their life cycle (often inshore estuarine waters, but not exclusively).

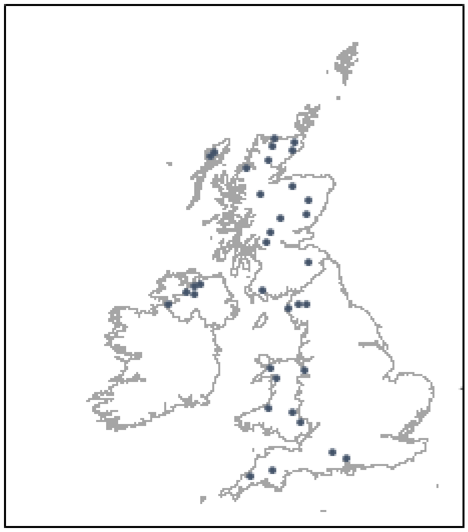


Figure 1. SACs with Atlantic Salmon as a qualifying feature. Dots represent centre point of site. From JNCC's ([Natura 2000 (N2K) site summary details spreadsheet | JNCC Resource Hub]())

In order to meet the conservation objectives for English sites, the populations need to be restored as it is acknowledged that there has been a historical decline in Atlantic Salmon. The supplementary advice on conservation objectives for English sites also states that '*controls on exploitation should take account of migratory passage within territorial waters, including estuarine and coastal net fisheries, as well as exploitation within the river from rod fisheries*'

Some IFCAs already have management measures (i.e., netting byelaws) in place. These have been introduced for a range of reasons, including salmon (and in some cases shad) protection. For example, in the southern and south-western areas of England, netting restrictions include:

- physical; at least three metres of net headline clearance (Devon & Severn IFCA netting byelaw, 2018)
- spatial; no netting within estuaries (Devon & Severn IFCA netting byelaw, 2018; Southern IFCA netting byelaw, 2021; Cornwall IFCA river and estuarine fishing nets byelaw, 2017)
- temporal; in some instances, seasonal restrictions in certain locations at certain times of the year (Devon & Severn IFCA netting byelaw, 2018; Southern IFCA netting byelaw, 2021; Cornwall IFCA river and estuarine fishing nets byelaw, 2017).

In addition the high level of protection specifically given to bass nursery areas in the south and south-west generally overlaps spatially with where rivers with freshwater

SACs designated to protected salmon reach the coast. Generally these protections include estuaries and some coastal waters

Despite evidence demonstrating that there is a clear bycatch risk for salmon, the quantitative evidence (i.e., how many are being caught) required to assess the scale of impact is still lacking. For example, using preliminary data from the SAMARCH project (2021), every 200m of fixed net could be projected to catch 0.18 salmon (i.e., 11 fish caught over 58 netting excursions), but this is largely speculation as the project set out to intentionally capture salmonids for genetic analysis (i.e., fixed nets were set without any head height clearance and close to shore near estuarine inlets), rather than reflecting the realistic operations of commercial fishermen. More information on inshore activities is also needed. Some of this may be available soon via iVMS and Catch App, but additional details such as length of net used and soak times may also be required

Without appropriate quantitative evidence, assessing the impact on SAC conservation objectives remains difficult, although the threat is clear and one which the Environment Agency treat seriously.

Allis Shad and Twaite Shad

There is a risk to both shad species from static nets as are recorded in bycatch monitoring and observer programmes (For example Northridge at al 2011). They can be caught within their marine feeding grounds and in coastal areas during spawning migrations. Reported total UK landings of shad per year vary but can be several thousand kilogrammes (ICES 2014). - The only UK spawning populations of both species are restricted to rivers and estuaries in the southwest of the UK and are a qualifying feature of 7 SACs there; Plymouth Sound & Estuaries SAC protects Allis shad, the Severn Estuary SAC protects Twaite shad, and the remaining 5 sites protect both species.

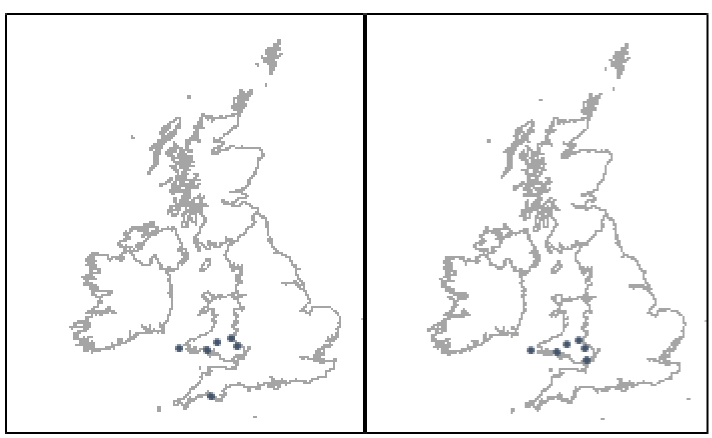


Figure 2. SACs with Allis shad (left) and Twaite shad (right) as a qualifying feature. Dots represent centre point of site. From JNCC's (Natura 2000 (N2K) site summary details spreadsheet | JNCC Resource Hub)

In order to meet conservation objectives for Shad sites, the populations need to be restored. Access to spawning habitats (For example barriers from weirs) is a key driver for the current status. The supplementary advice on conservation objectives for English sites states that *'controls on exploitation should include migratory passage within territorial waters, including estuarine and coastal net fisheries as well as exploitation within the river from rod fisheries.'* It also says *'By-catch of shad within commercial coastal and estuarine fisheries should be minimised through suitable changes to fishing patterns and methods and releasing any individuals caught alive*'.

A study by Trancart *et al.* (2014) aiming to model shad distribution used observer programme data to identify bycatch in French commercial fishing activities from the coast to continental shelf of North-Western France and throughout the English Channel. The study used a large dataset (2003 – 2010; >9,000 trawls, 43 different gear types, 6 – 320mm mesh size range) and reported a relatively high proportion (18.69%) of shad bycatch in fixed gillnets.

A review of vulnerable species bycatch by Northridge et al (2011) noted 190 shad in static gear caught between 1999 and 2009 from a total of 1,698 hauls. However, as this was from surveys focused mainly on cetaceans and not optimised for other taxonomic groups, the data were not extrapolated across the fleet as estimates would not be robust. A CEFAS observer programme report (2015; *unpublished*) reported more bycatch in the south/southwest with a particular hotspot in the southwest for Allis shad. Additionally, Wilson & Veneranta (2019) report differentiation between the two shad species, with higher propensity to catch Allis shad in set gillnets in comparison to Twaite shad (which are more commonly caught in beam and midwater trawls). Unpublished telemetry data shows shad have high year-on-year fidelity to marine feeding habitats which could increase the risk of bycatch in gillnets.

Despite evidence from several sources that show there is a bycatch risk from netting, assessing the impact in relation to SAC conservation objectives is difficult. The data are not sufficient to understand the scale or the spatial resolution of bycatch and the impact this may have on conservation objectives of the SACs. IFCA netting byelaws (see section on Salmon) may be providing some mitigation, especially in and around estuaries.

Conclusion

It is clear that coastal netting for bass poses risks to salmon outside the boundary of their protected sites (which only covers freshwater areas associated with spawning) and this may be at a scale that could impact the conservation objectives.

It is evident that some key mitigation measures are currently implemented by IFCAs across England, but there is still a large amount of uncertainty around salmon bycatch occurrence rates and geographic location. More data on salmon bycatch, including improved reporting, is needed to understand what, if any, additional management is required.

For shad species, the bycatch and landings data does show a risk of capture within nets. How significant this is for shad from SACs is not yet understood and requires further data to establish the exact locations and scale at which bycatch is occurring. Improving reporting pathways will aid increased understanding.

Whilst current measures to protect bass stocks may have benefits for salmonids and shad, they should not be relied upon as they are subject to change based on the bass stock and the outcome of bilateral negotiations.

More information on inshore activities is needed. Some of this may be available soon via iVMS and CatchApp, but additional details such as length of net used and soak times may also be required.

The impact on other MPA mobile fish species is not thought to be of a scale that is of concern, although there is a lack data.

Bycatch risk to bird MPA features (outside of sites) from netting for bass

It is well recognised that static gillnet net fisheries can pose a bycatch risk to seabirds. Anderson et al (2022) states that '*Recent studies have provided evidence that identifies the UK offshore demersal longline fishery and <10m static net fisheries as the highest priority fleets with which to target further seabird bycatch mitigation measures due to observed bycatch.'* A proportion of this <10m static net fishery will be catching bass.

Northridge et al (2020) included static gillnets nets in preliminary estimates of seabird bycatch by UK vessels in UK and adjacent waters, alongside longlining and midwater trawling. This was based on monitored fishing operations carried out under the UK Bycatch Monitoring Programme since 1997. Sampling effort was relatively small covering <1% of the annual UK static net effort. Accordingly, the report cautions that '*estimates must be considered preliminary as some are derived from very small sample sizes, and potential sampling biases have not been addressed'.* Miles et al (2020) took these estimates for 10 seabird species and used population models to predict population size in absence of this bycatch mortality over 25 years. Bycatch mortality for all gears was estimated to be more than 1% of total adult mortality for seven of the 10 species, with three of these (great cormorant, great northern diver and northern fulmar) showing a greater than 1% increase in estimated population size following *removal* of bycatch mortality over a 25-year period. Again, the report cautions that estimates should be treated as preliminary, partly due to '*inadequacies with current bycatch monitoring and data limitations.'*

There are many bird species that are protected under their own type of designated site (Special Protection Area – SPA). Of the 109 UK SPA species and subspecies listed by JNCC, 39 can be considered 'seabirds' for the purposes of this work, by cross referencing against a list within work by Bradbury et al (2019). Balearic shearwater can be added to this list as the non-breeding population found in UK waters breed in Mediterranean SPAs.

Of these 40 species, 10 species appeared as bycatch in the dataset analysed by Northridge et al. A further 5 gull species may have been caught as several gulls of indeterminate species were noted. Of the gull species that could be identified (Herring gull, Great black-backed gull, and black-legged kittiwake), only Herring gull were caught in static nets. Estimated bycatch of Herring gull was in the order of several tens of birds a year. Population modelling by Miles et al (2020) suggested a minimal impact on population over 25 years if this bycatch was removed (0 – 0.2%). For those gull species that couldn't be identified, work by Bradbury et al (2019) that categorised the risk to seabird species and considered behavioural traits suggest that they are at a lower risk of entrapment from fishing gear. Gull species bycatch is therefore not considered to be of a scale that could potentially impact SPA conservation objectives.

For the 7 non-gull SPA species, all had modelled population response to removal of bycatch where the upper limit exceeded 1%. This was used as the threshold where impact on the SPA which they are associated with might be impacted. The following text covers those species. This is based on the work by Northridge et al (2020) and Miles et al (2020). SPA populations information come from NE databases for English sites out to 12nm. For other UK sites, it comes from JNCC datasets. Information on foraging ranges comes from Woodward et al 2019.

Great Northern Diver

A single individual was caught in coastal static net fisheries. Scaled up, the total annual bycatch is estimated to be low (between 0 and 32 with a median of 11). However, population modelling suggests that without bycatch, UK population could increase by 0 – 9.1% in 25 years and Miles et al suggested Great Northern Diver was one of three species that were predicted to experience substantial potential gains from bycatch mitigation. 6 SPAs in the UK have Great northern diver as a feature – Falmouth Bay to St Austell Bay off the Cornish coast and 5 Scottish sites.

Low population counts in several sites (n=74 in Falmouth Bay to St Austell Bay) makes it difficult to rule out the relatively low incidence of bycatch as having implications for site conservation objectives. Some of this predicted bycatch will be occurring within the site and therefore should be considered by the IFCA under the revised approach. Panter and Liley (2017) analysed bycatch data within the site which showed Great northern diver was being caught and investigated the factors that influenced bycatch. It is likely there will also be a risk of bycatch outside the site, although the scale of risk is unclear.

Spatially, the bass fishery (which is largely in the south and west of England) is in close proximity to the Falmouth to St Austell bay SPA which is likely to increase risk. The Great Northern Diver is largely a winter visitor and is unlikely to be found in the bass fishery area outside this time.

Gannet

Gannet was recorded as bycatch in offshore static nets (n=15) and longlines (n=9). Scaled up, the total annual bycatch is estimated at a few hundred a year. Population modelling suggests that without bycatch, UK populations could increase by 0 – 2% in 25 years. 12 SPAs in the UK have Gannet as a feature, with all but 2 (Flamborough & Filey Coast in north-east England and Grassholm in Wales) being in Scotland. 100% of the English breeding population breed within SPAs and therefore contribute towards site conservation objectives.

The Gannet population is currently growing (at least before the outbreak of bird flu) so bycatch might not represent an issue that is impeding populations within SPAs.

Spatially, the bass fishery (which is largely in the south and west) is not in close proximity to most SPAs which are in the north. However, gannet forage over extensive distances (max 790km, mean max 315 ± 194km) meaning some spatial overlap may occur, especially the gannetries at Grassholm and also sites on the Channel Islands which are not included in the site count above.   The risk to individuals associated with these sites in the breeding season is probably still relatively low due to spatial separation. Outside the breeding season, however, there could be more overlap.

Shag

Shag was recorded as bycatch with 5 being caught in coastal static nets. Scaled up, the total annual bycatch is estimated to be fewer than a hundred birds a year.

Population modelling suggests that without bycatch, UK populations could increase by 0 – 3.6% in 25 years. 16 SPAs in the UK have Shag as a feature, with all but 1 (Isles of Scilly SPA) being in Scotland.

An estimated 68% of the English breeding population breed within SPAs and therefore contribute towards site conservation objectives.

Spatially, the bass fishery (which is largely the south and west) is in close proximity to the Isles of Scilly SPA which is likely to increase risk, although with maximum foraging ranges of less than 50km in the breeding season, the area of overlap is small and probably restricted to around the islands and the extreme tip of Cornwall. Outside the breeding season, however, the overlap could extend into more areas.

Guillemot

Guillemot was the most frequently recorded bycatch species in the work by Northridge et al. 267 were caught in static nets and 27 on longlines. Scaled up, the total annual bycatch is estimated to be in the region of a few thousand. Population modelling suggests that without bycatch, UK populations could increase by 0.5 – 1.9 % in 25 years. 37 SPAs in the UK have Guillemot as a feature, with all but three (Farne Islands, Flamborough & Filey Coast, and Northumberland Marine) being in Scotland. Populations within English sites range from 32875 to 65751 pairs.

An estimated 85% of the English breeding population breed within SPAs and therefore contribute towards site conservation objectives.

Spatially, the bass fishery (which is largely in the South and West) is not close proximity to the SPAs which are in the North and beyond the limit of Guillemot foraging range (max 338km). Therefore the risk to individuals associated with these sites in the breeding season is negligible. Outside the breeding season, however, there could be overlap.

Razorbill

Razorbill was recorded as bycatch with 12 being caught in static nets and three in midwater trawls. Scaled up, the total annual bycatch is estimated to be approximately 100 – 200 birds. Population modelling suggests that without bycatch, UK populations could increase by 0 – 1.1% in 25 years. 19 SPAs in the UK have Razorbill as a feature, with all but 1 (Flamborough as Filey Coast) being in Scotland or Northern Ireland. Populations within the English site is 10570 pairs. Cumbria Coast MCZ also lists Razorbill as a protected feature.

An estimated 87% of the English breeding population breed within SPAs and therefore contribute towards site conservation objectives.

Spatially, the bass fishery (which is largely in the South and West) is not close proximity to the SPAs or MCZ which are in the North and beyond the limit of Razorbill foraging range (max 313km). Therefore the risk to individuals associated with these sites in the breeding season is negligible. Outside the breeding season, however, there could be overlap.

Northern Fulmar

Fulmar was recorded as bycatch with 11 being caught in static nets and 176 on longlines. Scaled up, the total annual bycatch is estimated to reach several thousand birds. Population modelling suggests that without bycatch, UK populations could increase by 2.1 – 18.3% in 25 years. Miles et al suggested Northern Fulmar was one of three species that were predicted to experience substantial potential gains from bycatch mitigation though most of this will be associated with longlines. For the purposes of this work, assuming a ratio of 1:16, netting might account for 0.1 and 1.1% respectively. So while the issue of bycatch is largely from longlines, the impact from static nets may not be negligible.

Spatially, the bass fishery (which is largely in the South and West) is not close proximity to the SPAs which are in Scotland. However, the species does forage over great distances (max 2736km, mean max 542±657 km), so spatial overlap is not impossible. Outside the breeding season, however, there could be overlap. An estimated 51% the English breeding population breed within SPAs and therefore contribute towards site conservation objectives.

Great Cormorant

Cormorant was recorded as bycatch with 40 being caught in static nets (much more frequently in the coastal sector) and two in midwater trawls. Scaled up, the total annual bycatch is estimated to be in the region of several hundred birds. Population modelling suggests that without bycatch, UK populations could increase by 0.9 – 32.9% in 25 years.

Miles et al suggested Great Cormorant was one of three species that were predicted to experience substantial potential gains from bycatch mitigation

There are no English marine SPAs with Cormorant as a feature with a single inland SPA (Abberton reservoir). There are seven SPAs in Scottish waters and one each in Wales and Northern Ireland that are listed as having Cormorant as a feature.

42% of the English breeding population breed within SPAs and therefore contribute towards site conservation objectives.

Spatially, the bass fishery (which is largely in the south and west) is not in close proximity to the SPAs and the species forages relatively close to breeding sites (max 35km). Therefore, the risk to individuals associated with these sites in the breeding season is negligible. Outside the breeding season, however, there could be overlap.

Conclusion

Despite the acknowledged risk, the lack of a good data set makes it difficult to estimate the overall risk of bycatch to bird populations from netting with any degree of confidence. Northridge et al and Miles et al caveat their estimates accordingly and this should be reflected here. Trying to then draw conclusions at an increased resolution by linking birds with individual SPAs and considering the bass fishery alone only increases uncertainty.

There are seven bird species that are associated with SPAs (Great Northern Diver, Gannet, Shag, Guillemot, Razorbill, Northern Fulmar and Great Cormorant) where overall bycatch from gillnets is predicted to exceed 1% of adult mortality. This does not necessarily translate to a risk to SPA conservation objectives and the proportion that is relevant to nets catching bass is not known. Simple assessment of spatial overlap shows the bass fishery operates in close proximity to Falmouth Bay to St Austell Bay SPA protecting Great Northern Diver and the Isles of Scilly SPA protecting Shag. While some of the risk may be mitigated by management within the sites, the risk may also extend outside site boundaries.

When considering foraging ranges, there may also be some potential for the bass fishery to overlap with Gannet and Fulmar from SPAs in the nesting season due to the extreme distances they can travel from nesting sites.

Outside of the breeding season, more species from SPAs may be present within the bass fishery area. Depending on which of the seven species mentioned above is being considered, between 42% and 100% of breeding individuals in English waters are associated with SPAs. This gives an initial indication on the probability of functional linkage between an individual bird and an SPA.

There are tested methods that exist that can estimate the proportion of a bird species in an area that are associated with SPAs both inside and outside the breeding season (more details available on request). These are used for offshore wind HRAs. These methods would allow greater understanding on whether the level of bycatch was of concern in relation to an SPA. However, in order to do that, an estimate of the total precited bycatch of a species associated with the fishery in an area would be required. Currently, there is insufficient data to base this on with sufficient confidence. The results of a study on UK seabird bycatch hotspots by Northridge *et al* mentioned in the report by Miles et al may be particularly helpful understanding the issue in more detail.

In order to understand the risk to SPAs, additional monitoring on bird bycatch will be required to fill the significant data gaps that currently exist. Changes could be built into existing programmes, such as the UK Bycatch Monitoring Programme (BMP) and additional data collection may be possible through the appropriate use of REM or self-reporting apps. Ensuring a clear process exists for IFCAs and/or the MMO to highlight known hotspots for bird bycatch to national monitoring programmes may also be of benefit. A better understanding of the spatial scale of the fishery (For example through iVMS) will also greatly facilitate appraisal of the risk (and hence management).

Bycatch risk to mammal MPA features (outside of sites) from netting for bass

Nets have long been recognised as posing a risk to marine mammals. The Bycatch Monitoring Programme was established to collect data on marine mammal bycatch to meet various international obligations. The results of the programme estimated that in 2019, between 502 to 1560 harbour porpoises, 375 to 872 seals (both grey and harbour), and 165 to 662 common dolphins were caught.

Four marine mammal species are features of MPAs in the UK. Harbour porpoise, grey seal, common seal, and bottlenose dolphin. Note that as there are no MPAs for common dolphins, the impact on this species is not relevant to this advice.

Harbour porpoise

The most important current anthropogenic pressure on harbour porpoises in NW European waters is bycatch (IAMMWG, 2015). Seven SACs in the UK list Harbour porpoise as a feature. Two sites, Southern North Sea SAC and Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC occur in part or in whole in English waters. They are both very large sites whose boundaries were determined by persistence of use. The size makes them different from many other protected sites for mobile species that often only cover small areas important for critical life stages such as breeding or spawning.

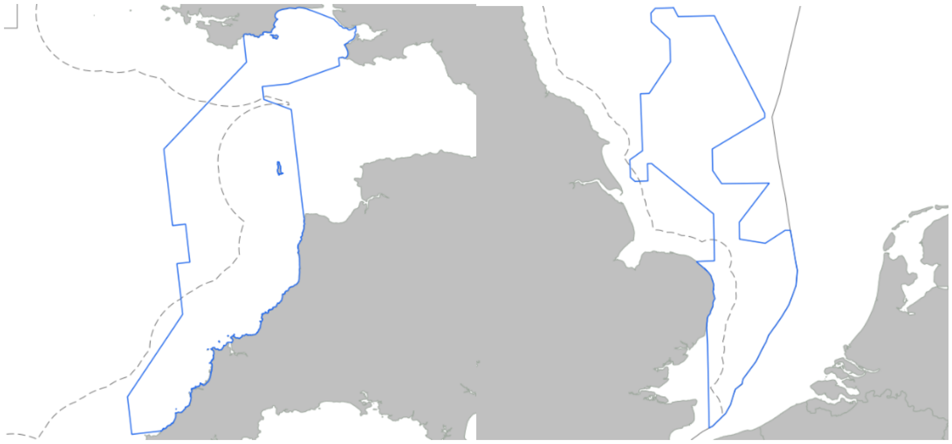


Figure 3 –Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC (left) and Southern North Seas SAC (right)

Much of the work on the monitoring and protection of cetaceans in UK waters is done at the management unit level. The Southern North Sea SAC is in the North Sea Management Unit and the Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC is in the Celtic and Irish Seas Management unit.

Using point estimates, of the 883 harbour porpoises thought to have been caught as bycatch in 2019, 275 were estimated to have been caught by the type of light gillnet which is associated with commercial bass netting. This was the second largest, behind tangle/trammel nets (376). Spatially, most Harbour Porpoise were caught in ICES division 7e (304), 7d (199) and 7f (183) in the English Channel & Celtic Sea, and 4c (92) in the Southern North Sea.

Two of these divisions, 4c and 7f, have a degree of spatial overlap with SAC and therefore some of the bycatch could be occurring within the site boundary and should be considered by the MMO through the *revised approach* work. However, 7d and 7e have no spatial overlap, so most bycatch in the Celtic and Irish Seas management unit will be outside the SAC boundary. Risk mapping has highlighted that the use of gillnets in the eastern part of the English Channel (year-round) and the western Channel (between July and September) as relatively high risk to harbour porpoise (Evans *et al* (2021).

The Bycatch Mitigation Initiative outlines how the UK government and devolved administrations will achieve their ambitions to minimise and, where possible, eliminate the bycatch of sensitive marine species, including Harbour Porpoise. Each fisheries policy authority is responsible for setting out how they will take action on bycatch. Clean Catch UK is one of the initiatives Defra has established to develop and implement effective bycatch policies in England. The focus of Clean Catch UK research is currently in south-west England fisheries however the outcomes may be applicable to bycatch mitigation strategies in fisheries across the UK. Defra has yet to publish its action plan for how it intends to fully implement the BMI. Additional detail and an understanding of timeframes will be needed to know if these actions will be sufficient to address out of site impact on designated features of MPAs.

Cetacean bycatch mitigation decision trees have been developed by Natural England to help identify if a given fishery has bycatch and /or to get guidance on how to address a known bycatch problem. It is hoped that regulators and fisheries managers could use the decision trees to help understand cetacean bycatch in a fishery and to subsequently minimise or eliminate it. It had been suggested that the CCUK regional working groups may be a good place for these to start being used. We are currently unsure of Defra's intentions for CCUK and the regional working groups moving forwards, but these could be a useful tool for the group in helping develop wider bycatch mitigation strategies. The bycatch mitigation decision trees could be used within an FMP

Assessing the impact of bycatch occurring outside the site boundary on the conservation objectives within the site is complex, as most work focuses on impacts on the wider population within the *management unit*, rather than on the SAC. It is reasonable to assume that impacting the wider population has the potential to influence the viability of harbour porpoise within the site. As harbour porpoise bycatch in the Celtic Sea was above the precautionary threshold of 1% when last assessed (ICES (2016)), it is difficult to rule out the bass fishery impacting SAC conservation objectives. However, through a combination of assessment of management requirements inside the site by the MMO under the revised approach work, as well as ongoing work under the BMI to understand and mitigate the impact of bycatch on the wider population within the management unit (provided any required management measures are progressed in a timely manner), SAC conservation objective requirements should be met.

Grey and Harbour seals

There is a risk to seals from gill nets. The 2019 Bycatch monitoring programme report estimated that in that year, 488 seals (both grey and common) were caught in gill nets (95% confidence limit range 375-872). 90% is predicted to occur in tangle / trammel nets. For the light gillnets typically used for small species including bass, the point estimate of bycatch is zero. However, considering the 95% upper confidence limit range (90), it would suggest there is potentially some low levels of bycatch occurring.

Despite this uncertainty, it would appear that the risk to seals from light gillnets is more of an individual welfare concern rather than being at a level that that will impact the populations that reside in MPAs and therefore the conservation objectives of the site.

Bottlenose dolphin

There are three SACs in the UK for bottlenose dolphin, although none are within English waters. Bottlenose dolphins are not recorded as bycatch within the 2019 bycatch monitoring report, although the 2018 report does state that there has been observed bycatch of the species in the past (see Northridge et al 2019). This suggests that bycatch is a relatively rare occurrence. It is potentially therefore not be at a level that is a concern when considering SAC conservation objectives, but as the sites are not within English waters, NE and JNCC are not best placed to offer advice.

Conclusion

Based on the available information, it would appear that the only MPA mammal feature at significant risk outside the site boundary from netting for bass is harbour porpoise, although it should be noted that there is currently ongoing work looking to understand and mitigate this under different legislative drivers. As bycatch monitoring work pulls in data from more than a single fishery, further analysis or targeted evidence collection may help understanding where the specific risks are. Through a combination of assessment of management requirements inside the site by the MMO under the revised approach work, supported by ongoing work looking at understanding and mitigating the impact of bycatch on the wider population within the management unit (provided required management measures are progressed in a timely manner), SAC conservation objective requirements should be met.

Bycatch risk to MPA features (outside of sites) from other bass fishing methods.

Hook and line

Around 55% of bass landings between 2016 and 2020 were caught using hook and lines.

Fish

Considering fish mobile MPA features, of the 10 species considered (Atlantic Salmon, Allis shad, Twaite shad, River lamprey and Sea lamprey, Long snouted seahorse, short snouted seahorse, giant goby, couch's goby and smelt), only Atlantic Salmon and the two shad species are likely to be caught. There is no direct evidence with which to assess the scale of the risk. It is illegal to retain catch of allis and twaite shad so they should be returned unharmed. This should be possible, given the method of fishing for bass which is via rod and line rather than static long line, although small levels of mortality may occur. If post capture release is carried out, the impact should be minimal.

Birds

Considering birds mobile MPA features, longlines are known as presenting a significant risk to species such as Northern Fulmar (Northridge et al 2020). However, the 'hook and line' in this instance is not longline but rod and line. The risks are therefore not comparable. There is little evidence on the risk of rod and line, but there is anecdotal evidence that birds can be occasionally caught and released alive. Anderson et al 2022 suggests that clear guideline on the safe handling and release if trapped birds can be considered an appropriate mitigation tool. It may be that this is appropriate for the bass fishery, unless future evidence suggests the risk is higher than currently anticipated.

Marine mammals

Considering marine mammal MPA features, the risk of rod and line is not currently considered to pose a significant risk and is not included within the UK Bycatch Monitoring Programme's sample regime. Although there are anecdotal reports of hooking into harbour porpoise when fishing with rod and line, it would appear to be only a very occasional occurrence and not one that is of a scale that is significant from an MPA perspective.

Conclusion

Bass fishing by hook and line does not appear to be resulting in levels of bycatch that are risk impacting MPA conservation objectives, but there is not much evidence on which to base conclusions upon. It is assumed that rules relating to returning Salmon and shad species are adhered to, but there may be cases where they are not. Bird bycatch, although known to occur occasionally, could be mitigated to a certain degree by safe handling and release. Improved monitoring and reporting regimes were appropriate would allow greater confidence in conclusions. This would also allow for any issues that we are currently unaware of the be recognised and appropriately mitigated, if required.

Mobile Demersal Gear

A small proportion of bass were caught between 2016 and 2020 by otter trawls (~6%), beam trawls (~3%) and demersal seines (1-2%). Although the gear is not used to target bass, it has been included as method as it contributes to landings.

Fish

When considering fish mobile MPA species, there is a risk to shad species from trawling (notably beam and otter trawling). Reported total UK landings of shad per year vary but can be several thousand kilogrammes (ICES 2014). Trancart *et al.* (2014) found benthic bottom trawls accounted for 16.31% of shad bycatch occurrences. However, whilst the study highlights the geographic locations of each fishing activity with a good number of these within the English Channel, the study largely consists of bycatch from French waters, and therefore doesn’t provide adequate insight into locations relevant to the bass fishery nor the quantity of shad caught.

This data, alongside other bycatch and landings data does show there is a risk of bycatch within demersal trawls. How significant this is for shad from SACs is not yet understood. Further data would help establish the locations and scale of bycatch. Improving reporting pathways and bycatch monitoring programmes will help improve understanding.

Birds

When considering bird mobile MPA species, benthic trawling does pose a certain risk to certain species, highlighted by both anecdotal reporting during fish bycatch monitoring (For example CEFAS observer programme report (2015; unpublished)), and by previous work looking at the relative risk based in part of behavioural traits (Bradbury et al 2019). This highlights deep diving shags, scaups, eiders, scooters, guillemots, great northern divers and cormorants as the most sensitive for gears used in deep waters near the seabed. Risk mapping showed hot spots south of Farne Deeps, around the Scottish Coast, the North Channel and the couth coast of Devon, and in the English Channel and off Cornwall in winter.

Benthic trawling is not included in more recent work looking at seabird bycatch (For example Northridge et al, 2020) and is not generally considered to present a high bycatch risk to birds, with work tending to focus on the impacts of netting, longlining and in some cases pelagic trawling. A working assumption could be made that the likelihood that bird bycatch is having significant impacts on SPAs is therefore low. Improved monitoring regime on benthic trawlers is needed to fill the current data gaps that lead to uncertainties. This could potentially be done by adapting or expanding existing observer programmes, or through the appropriate use of REM.

Marine Mammals

Benthic trawling is not included in the UK Bycatch Monitoring Programme, because it is not currently considered to be a high risk activity. However, the 2019 report did also include information from non-dedicated sampling in under the English / Welsh DCF discard programme which focuses heavily on demersal trawl gears. No marine mammals were recorded but it is noted that sampling protocols are not specifically designed for quantifying protected and sensitive species. Historically, there is evidence that shows harbour porpoise is occasionally caught by beam and otter trawlers (CEFAS observer programme report (2015; unpublished)). However, the current understanding is this is not at a level that could have impacts on population. It is therefore also unlikely that isolated instances of bycatch outside of the boundaries of MPAs for harbour porpoise is of a scale to impact conservation objectives.

Conclusion

The small proportion of mobile demersal gear involved to the capture of bass is unlikely to be presenting a significant risk to mobile MPA species, but there are gaps in evidence. There is a need to have a better understanding on the risk posed by such gear to Shad species in particular but given the relatively limited proportion of the bass caught using otter trawls, beam trawls or demersal seines, this is unlikely to be contributing significantly to any bycatch. Improved monitoring and reporting regimes were appropriate would allow greater confidence in conclusions. This would also allow for any issues that we are currently unaware of the be recognised and appropriately mitigated, if required.

Risk of prey species bycatch

Forage fish are fish that are important food sources for higher trophic levels of marine foodwebs. They are often (but not always) small, pelagic schooling fish. There is no single defined list of forage fish and it ultimately it depends on the predator species of interest and on spatial and temporal aspects of the marine food web.

The following species can be considered forage fish for some marine predators, although some are only preyed upon at specific life-history stages (often as juveniles of a specific size range): herring, sardine, sprat, anchovy, lesser sandeel (sandeel), raitt's sandeel, smooth sandeel, greater sandeel (Launce), corbin's sandeel, horse mackerel (scad), mackerel, boarfish, blue whiting, whiting, cod, norway pout, poor cod, greater silver smelt (greater argentine), and garfish.

Bass are not generally thought of as forage fish, although juveniles may be a locally important prey to some predators. It is not thought that any of the gears used to catch bass will have a significant impact on any of the forage fish species listed above, due to the selectivity of the gears used to target bass.

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Nature conservation risks arising from FMPs to UK MS Descriptors

Under the UK Marine Strategy Regulations (2010), the UK has a responsibility to take the necessary measures to achieve or maintain GES, set out through the UKMS. The UKMS provides the policy framework for delivering marine policy at the UK level and sets out how the vision of clean, healthy, safe, productive, and biologically diverse oceans and seas will be achieved. The target for GES is measured through 11 qualitative descriptors, which describe what the environment will look like once GES has been achieved.

The following risks to UK Marine Strategy descriptors in English and Welsh waters arising from bass gillnet, hook and line and demersal trawl fisheries have been identified below.

Gear	D1, D4 Biodiversity and food webs, Cetaceans	D1, D4 Biodiversity and food webs, Seals	D1, D4 Biodiversity and food webs, Birds	D1, D4 Biodiversity and food webs, Fish	D3 Commercial fish and shellfish	D4 Foodwebs	D1, D6 Seafloor integrity	D10 Marine Litter
Bottom otter trawl (OTB)	Better evidence required.	Better evidence required.	Better evidence required.	Further work by ALBs required in first instance.	No action required beyond FMP scope.	No action required beyond FMP scope.	Collaborative, strategic response required.	More data collection required. Some strategic mitigation possible.

Set gillnets (GNS)	Targeted evidence collection and possible mitigation required.	Targeted evidence collection and possible mitigation required.	Targeted evidence collection and possible mitigation required.	Further work by ALBs required in first instance.	No action required beyond FMP scope.	No action required beyond FMP scope.	No action currently thought to be required.	More data collection required. Some strategic mitigation possible.
Hooks and lines (LX)	No action. Better evidence beneficial	No action. Better evidence beneficial	No action. Better evidence beneficial	No action. Better evidence beneficial	No action required beyond FMP scope.	No action required beyond FMP scope.	No action currently thought to be required.	More data collection required. Some strategic mitigation possible.

Bycatch:

D1 & D4 - Biological diversity of cetaceans

The highest direct risk identified posed by fisheries on cetaceans is their incidental bycatch. As well as presenting a risk to species associated with MPAs (considered earlier in this document), netting in particular poses a bycatch risk to other sensitive species. The risk to sensitive fish/bird/mammal species is **high**.

Harbour porpoise and nets

Currently, the most deleterious anthropogenic pressure on harbour porpoise in northwest European waters is fisheries bycatch (IAMMWG, 2015). The UK bycatch monitoring programme monitors the levels of bycatch in certain fisheries, gear types and areas and extrapolates the data to give an indication of the scale of overall bycatch levels (Kingston et al. 2021). The fisheries monitored are nets, pelagic trawls, longlines and ring nets, as these are currently considered to present the greatest risk. Kingston et al. (2021), gives the harbour porpoise bycatch point estimate for 2019 as 833 individuals, assuming full compliance with acoustic deterrent device rules, which apply to >12m vessels. The metiers responsible for the highest estimated harbour porpoise bycatch were tangle/ trammel nets (376) and light gillnets (275). Other gillnets such as those targeting hake or flatfish and drift nets also contributed to overall bycatch, but at lower reported levels (Kingston et al. 2021).

In order to be compatible with UKMS GES targets, fisheries must not result in a situation where the long-term viability of a cetacean population is threatened by incidental bycatch. In addition, there should be no significant decrease in abundance caused by human activities and the population range should not be significantly lower than the favourable reference value for the species. Currently, for harbour porpoise the bycatch target is deemed to being achieved if estimated bycatch is below a threshold of 1% of the best population estimate.

According to 2016 estimates, annual bycatch estimates in the North Sea were below this threshold (0.36-0.58%) but above it in the Celtic Seas (1.06 -1.37%). However, according to the Bycatch Monitoring Programme Report for 2019 (Kingston et al 2021) harbour porpoise bycatch mortality in the Celtic Seas may now be below the 1% precautionary threshold. Thus the extent and risk of bycatch from fisheries may vary around the stated threshold value.

In conclusion, harbour porpoise bycatch in nets <u>is</u> currently of a scale that could threaten GES targets for D1, D4 cetaceans.

Risk of netting to other cetaceans

Common dolphin is regularly reported as bycatch within the UK Bycatch Monitoring Programme. The programme monitors the levels of bycatch in certain fisheries, gear types and geographic areas and extrapolates these data to give an indication of the overall scale of bycatch levels. The fisheries monitored are static nets, pelagic trawls, longlines and ring nets, as these are currently considered to present the greatest risk. In 2019, the common dolphin bycatch point estimate was 278 (Kingston et al. 2021). The metiers responsible for the bycatch were tangle / trammel nets (164) gillnets for hake (66) gillnets (24) and light gillnets (24). Spatially, bycatch of common dolphin is concentrated in ICES Divisions 7e-g.

Bottlenose dolphins are not regularly reported via the UK Bycatch Monitoring Programme and therefore estimates of total bycatch across the fleet have not been made. However, bottlenose dolphin is listed as one of the three species where bycatch presents the highest conservation threat in south-west UK waters by Clean Catch UK (alongside harbour porpoise and common dolphin). The reason for this disparity is unclear but may be due to the highly localised nature of the risk to coastal populations of bottlenose dolphins that is not adequately represented within the ongoing monitoring programme.

In order to be compatible with UKMS GES targets, fisheries must not result in a situation where the long-term viability of a cetacean population is threatened by incidental bycatch. No information could be readily found on environmental mortality limits for common dolphin or bottlenose dolphin. It is therefore not possible to assess against the incidental bycatch target.

Abundance trends do not appear to be available for common dolphin. Abundance trends for bottlenose dolphin are available (Pinn et al, 2018). For the four groups of coastal bottlenose dolphins in UK waters, the target of ‘no statistically significant decrease in abundance’ was met for the greater North Sea and the largest group in the Celtic seas found off Wales. However, there is insufficient monitoring data to establish trends in abundance for bottlenose dolphins off the west Coast of Scotland and off the coastal south-west of England.

In conclusion, several hundred common dolphin are estimated to be bycaught in nets each year but it is not yet possible to determine how much of a threat this poses to GES targets for D1 D4 Cetaceans. Estimates of bycatch of bottlenose dolphin are not available but concern has been raised on the levels of bycatch in the south-west. Again, it is not clear how this relates to GES targets for D1 D4 Cetaceans.

The OSPAR Intermediate Assessment (2017) reported insufficient information to assess changes in distribution over time except for (in relation to the UK only) harbour porpoise, white-beaked dolphin and minke whale in the North Sea, where there are comprehensive data from 1994, 2005 and 2016, and additional years for minke whale. Between 1994 and 2005, the distribution of harbour porpoise in the North Sea shifted markedly from primarily in the north to primarily in the south; this shift was maintained in 2016 and more sightings were made throughout the English Channel in 2016 than in previous years. There is some evidence of a similar but weaker pattern for minke whale. White-beaked dolphin distribution did not appear to change between 1994 and 2016.

Three or more comparable estimates of abundance are only available for harbour porpoise, white-beaked dolphin and minke whale in the North Sea. There is no evidence of any trend in abundance for these species in these regions. For other species, it is not possible to assess with any confidence whether populations are decreasing, stable or increasing. Nevertheless, the most recent estimates of abundance for 2016 are similar to or larger than earlier estimates for comparable areas. There is moderate confidence in the methodology though low confidence in the data availability.

The OSPAR assessment also identified harbour porpoise as subject to high risk to bycatch in the OSPAR Maritime Area; common dolphin and minke whale were reported as being at medium risk, but with no direct reference to static nets.

Risk from other gear types

As well as netting and entanglement in pot ropes, other gears can pose a bycatch risk to cetaceans. Benthic trawling is not included in the UK Bycatch Monitoring Programme, because it is not currently considered to be a high-risk activity. However, the report of bycatch levels in 2019 report (Kingston et al. 2021) did also include information from non-dedicated sampling in under the English / Welsh Data Collection Framework discard programme which focuses heavily on demersal trawl gears. No marine mammals were recorded but it is noted that sampling protocols are not specifically designed for quantifying protected and sensitive species. Historically, there is evidence that shows harbour porpoise are occasionally caught by beam and otter trawlers (CEFAS observer programme report, 2015; unpublished). However, the current understanding is this is not at a level that would have impacts on the population.

Similarly, rod and line fishing is not currently considered to pose a significant risk to cetacean populations and is not included within the UK Bycatch Monitoring Programme's sampling regime. Whilst there are anecdotal reports of bycatch of harbour porpoise when fishing with rod and line (albeit not in fisheries associated with frontrunner FMPs), it would appear to be only a very occasional occurrence and not at a level that could have impacts on population.

D1 & D4 Biological diversity of seals

Bycatch is thought to be the biggest fisheries pressure facing seals, although *grey* seals appear to be reaching many of their GES targets.

Static nets pose a risk of bycatch to many sensitive species including seals. The UK bycatch monitoring programme monitors the levels of bycatch in certain fisheries, gear types and areas and extrapolates the data to give an indication of the scale of overall bycatch levels. The fisheries monitored are static nets, pelagic trawls, longlines and ring nets, as these are currently considered to present the greatest risk. In 2019, the seal bycatch point estimate was 488 (Kingston et al 2021). Most, if not all, of these were thought to be grey seal. The vast majority (455 out of 488) were caught in tangle / trammel nets.

In order to be compatible with UKMS GES targets, fisheries must not result in a situation where the long-term viability of a seal population is threatened by incidental bycatch. In addition, there should be no significant decrease in abundance caused by human activities and population range should not be significantly lower than the favourable reference value for the species.

The 488 grey seals estimated to have been caught in 2019 represents 1.5-2.9% of the population. There are no set “environmental mortality limits” set for grey seals (Kingston et al 2021) meaning assessment against the incidental bycatch target is not possible. However, it would appear that grey seal abundance targets are being met and the recent population trajectory in both the Celtic and North Sea is steadily increasing. The current status of the common seal populations, which is below target levels, is not thought to be due to bycatch. In conclusion, while a direct assessment on whether netting bycatch of seals is not possible due to no environmental mortality limits being set, the current population trajectory of grey seals suggests it may not be at a scale which threatens other GES targets.

D1 & D4 Biological diversity of seabirds

The highest direct risk identified between fisheries contained in the frontrunner FMPs and seabirds is bycatch although this may vary from species to species.

Risk of bird bycatch from netting

It is well recognised that static gillnet net fisheries can pose a bycatch risk to seabirds. Anderson et al (2022) states that ‘*Recent studies have provided evidence that identifies the UK offshore demersal longline fishery and <10m static net fisheries as the highest priority fleets with which to target further seabird bycatch mitigation measures due to observed bycat*ch.’

Northridge et al (2020) included static gillnets nets in preliminary estimates of seabird bycatch by UK vessels in UK and adjacent waters, alongside longlining and midwater trawling. This was based on monitored fishing operations carried out under the UK Bycatch Monitoring Programme since 1997. Sampling effort was relatively small covering <1% of the annual UK static net effort. Accordingly, the report cautions that *‘estimates must be considered preliminary as some are derived from very small sample sizes, and potential sampling biases have not been addressed*’. Miles et al (2020) took these estimates for 10 seabird species and used population models to predict population size in absence of this bycatch mortality over 25 years. Bycatch mortality for all gears was estimated to be more than 1% of total adult mortality for 7 of the 10 species, with three of these (great cormorant, great northern diver and northern fulmar) showing a greater than 1% increase in estimated population size following removal of bycatch mortality over a 25-year period.

Natural England’s advice to the English Seabird Conservation and Recovery Plan (ESCaRP) identified seabird bycatch as problematic; it lists 26 species that are at risk from bycatch in a range of gears (static gill nets, demersal longlines, purse seines, pelagic trawls and ghost fishing gear).

In order to be compatible with UKMS GES targets, fisheries must not result in a situation where the long-term viability of marine bird populations is threatened by deaths caused by incidental bycatch in mobile and static gear. In addition, the population size of species should not have declined substantially since 1992 as a result of human activities / there should be no significant change or reduction in population distribution caused by human activities; and there should not be widespread lack of breeding success in marine birds caused by human activities (no more than three years in six).

Preliminary estimates by Northridge et al 2020 and Miles et al 2020 does suggest that mortality of some bird species is at levels that significantly affects populations. Seven of the ten species investigated (great northern diver, gannet, shag, guillemot, razorbill, northern fulmar and great cormorant) had an estimated bycatch mortality that exceeded 1% of total adult mortality. Three of these species were at greatest risk: cormorant, great northern diver and northern fulmar although fulmar bycatch was largely due to longlines. While it is acknowledged that these are only preliminary estimates due to inadequacies in the underlying data, it suggests that the current level of bycatch from netting may not be compatible with meeting GES bird population targets.

In conclusion, while whilst significant uncertainties remain, preliminary estimates suggest that seabird bycatch in nets is likely to be occurring at a scale that could threaten GES targets for D1, D4 birds.

Risk of bird bycatch from hook & line fishing

There is little evidence on the level of bird bycatch risk from rod and line fisheries, but there is anecdotal evidence that birds can be occasionally caught and released alive. Anderson et al (2022) suggests that clear guideline on the safe handling and release if trapped birds can be considered an appropriate mitigation tool. It may be that this is appropriate for fisheries that use hook and line, unless future evidence suggests the risk is higher than currently anticipated. It is not anticipated that bird bycatch using rod and line will be of a scale that could threaten GES targets.

Risk of bird bycatch from mobile gear

Benthic trawling does pose some degree of bycatch risk to certain bird species, highlighted by both anecdotal reporting during fish bycatch monitoring For example , CEFAS observer programme report (2015; unpublished), and by previous work looking at the relative risk based in part of behavioural traits (Bradbury et al 2019). This highlights deep diving shags, scaups, eiders, scooters, guillemots, great northern divers and cormorants as the most sensitive birds to gears used in deep waters near the seabed.

Benthic trawling is not included in more recent work looking at seabird bycatch (For example , Northridge et al, 2020) and is not generally considered to present a high bycatch risk to birds, with work tending to focus on the impacts of netting, longlining and in some cases pelagic trawling. Benthic trawling is also not highlighted within NE recommendations to ESCaRP as an activity of concern related to seabird bycatch.

Therefore, while there are current data gaps that lead to uncertainties, current thinking is that bird bycatch by benthic trawlers is not at a scale that is likely to threaten GES descriptors. An improved monitoring regime is needed to fill gaps in data and understanding. This could potentially be done by adapting or expanding existing observer programmes, or through the appropriate use of Remote Electronic Monitoring.

D1 & D4 Biological diversity of fish

Because of the broad number of species included in assessments of some of the indicators for this descriptor, many gear types are scoped in as requiring action. This is partly because, other than for elasmobranchs, relatively little attention has been given to marine fish or the marine life-stages of migratory fish within existing sensitive species mitigation programmes or bycatch initiatives.

Seafloor integrity:

Descriptor D1 & D6 Seafloor integrity

Essentially, all mobile demersal gears pose a risk to this descriptor. Where demersal mobile gear is used to target Bass, benthic disturbance and the contribution to current failure to meet targets for D6 seafloor integrity. However, given that only a relatively small proportion of the fishery uses demersal mobile gear, this is considered a **moderate** risk.

Marine Litter:

D10 Marine Litter

Loss of gear such as trawls and nets will add to overall levels of fishing related litter within the sea and can have unintended consequences such as ghost fishing. Consideration of how best to avoid or minimise loss and achieve sustainable end of life disposal is important. This risk is considered moderate.

Gear specific estimates of rates of abandoned, lost, and discarded gear have low certainty due to a small number of studies and low sample sizes. Risks are highest in static gear fisheries (French et al 2022) where significant quantities of gear are deployed into the marine environment. Mobile gears are a lower risk but may be a source of plastic ropes and netting which contribute to non-biodegradable marine litter when lost, abandoned, or discarded at sea. Abandoned, lost, or discarded fishing gear is associated with entanglements and ghost fishing, However, fishing litter is likely to be a relatively small component of overall marine litter, therefore fishing measures alone are unlikely to contribute significantly to the achievement of GES.

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Natural Resources Wales advice

Background and context

Further to NRW’s initial high-level advice provided to Welsh Government on 13 December 2022, this document contains additional indicative nature conservation advice on the impacts from bass fishing in Welsh waters. It was requested by Welsh Government to inform the development of their Bass FMP under the Fisheries Act 2020. NRW’s advice considers the impacts of bass fishing on the protected features of Welsh MPAs and on Good Environmental Status (GES) under the Marine Strategy Regulations (2010). The advice has considered NE /JNCC’s related advice packages commissioned by Defra.

Only the impacts from commercial bass fisheries using anchored (or drift) nets or lines are considered, as we understand these to be the principal method of commercial bass fishing currently occurring within Welsh waters. However, we advise Welsh Government to also consider the impacts from the commercial targeting and bycatch of bass by mobile trawl gears, spear fishing and rod and line, along with recreational rod and line fishing, during any environmental assessment process related to the Bass FMP.

This advice is provided to Welsh Government without prejudice to any future advice which we may provide in relation to our statutory functions.

Summary of NE/JNCC nature conservation advice packages

As the Bass FMP is yet to be produced by the Fishery Policy Authorities, the NE/JNCC advice is general in nature.

The NE/JNCC advice relates to all MPAs both inside and outside 12nm, within English waters. It uses NE’s activity-pressure database which defines generic risk ratings (RPP scores) from OSPAR pressures associated with bass fishing (anchored nets or lines). These risk ratings are then expanded upon within the NE/JNCC FMP advice to identify whether they are considered to be a medium/high risk to; habitats, low mobility/static species, birds, marine mammals, or fish. However, there is no further resolution within these five groupings.

The NE/JNCC advice only considers the effects of activities outside sites on features inside and outside sites. It does not differentiate if a risk rating relates to a direct or indirect effect from a pressure on a feature and does not attribute separate; n/a, Low, Medium or High risk ratings.

The NE/JNCC advice does not consider the effects of activities inside sites on features inside sites or outside sites. Instead, they assume completed and ongoing programmes of fisheries assessment and management (2012 Revised Approach and 2020 Marine Management Organisation (MMO) Fisheries Assessments) will address those impacts.

NRW nature conservation advice on bass fishing in Wales

Risk screening

Welsh Government do not have the same fisheries management programmes to rely on as Defra. As such, when considering the effects from bass fishing, Welsh Government should consider the effects of activities occurring both inside and outside sites, on features occurring both inside and outside sites as relevant.

The first stage of NRW's advice to Welsh Government utilised the NE/JNCC Draft fisheries pressures and screening outside MPAs spreadsheet as a starting point. We created a new 'NRW BSS Nets or Line' tab and made the following additions and changes:

- Disaggregated each pressure risk rating for all features both inside and outside sites, using the same habitat and species groupings used in the NE/JNCC FMP advice;
- Combined the 'habitat' and 'low mobility species' groups into one 'habitat' group, to consider the substrate, flora and fauna of habitat features together;
- Considered the impacts from pressures occurring either inside or outside sites, on features inside and outside sites;
- Included Low (L) and not applicable (n/a) risk ratings1 in addition to separate Medium (M) and High (H) risk ratings for each activity-pressure pathway and habitat/species grouping. Not applicable (n/a) risk ratings were used where activity-pressure pathways were not considered to exist. Risk ratings were provided based on the expert judgement of NRW staff;
- Annotated the risk rating with direct (D) and/or indirect (I) pathways. Indirect pathways are described in the notes' column, as either having an indirect effect on the species through impacts to the features; supporting habitat, prey, or habitat of the prey;
- Considered the activity 'anchored nets/lines' to also include drift nets; and,

- Provided aggregated NRW Inside Site Risk (ISR) ratings and Outside Site Risk (OSR) ratings for each activity-pressure interaction. The NRW ISR or OSR ratings are based on the highest disaggregated risk rating across the habitats and species groupings.

NRW consider net fishing for bass to be the key commercial activity likely to cause impacts to protected features of Welsh MPAs. Other targeted methods of fishing for bass such as rod and line, spear fishing or trawling could result in different magnitudes of impact to protected features, and therefore should also be considered in Welsh Government’s statutory environmental assessments.

NRW’s advice will need to be added to by Welsh Government in any statutory environmental assessments with, for example, details on amounts, location, frequency and management of activities considered. The NRW ISR/OSR and NE/JNCC risk ratings do not consider conservation objectives. An assessment of the activity against Welsh conservation objectives may provide a different outcome than what is indicated in the NRW risk ratings.

Assessment requirements

An FMP for ongoing activities, such as bass fishing, would normally be assessed under Regulation 9 of the Conservation of Habitats and Species Regulations (CHSR) 2017. Meaning the Welsh Minister must take appropriate steps to avoid deterioration or disturbance to sites from the activities, for example, through existing or new management programmes.

Currently there are no existing or new programmes of bass fisheries management in Wales for Welsh Government to rely on when assessing bass fishing for the purposes of the Bass FMP. Additionally, there is no formal consideration of the impacts from bass fishing on features within or outside of protected sites in Welsh waters through an annual HRA process under Regulation 63 of the CHSR. Therefore, Welsh Government should consider the indicative risk assessments (ISR and OSR) from bass fishing with nets or lines wherever bass fishing can occur in Welsh waters.

In Wales, like England, the regulations governing bass fishing are complex2. Regulations include spatial, temporal and technical gear restrictions, with fishing for bass completely prohibited from some areas3 and partially restricted in others, such as nursery areas4. We advise that Welsh Government ascertains where spatial overlap can occur between permitted bass fishing and protected features in Welsh waters.

Habitat features

There are no High risk ratings for habitat features of Welsh MPAs from bass fishing with nets or lines. Table 1 presents the Medium risk ratings for habitat features of Welsh MPAs from bass fishing with nets and lines. The remaining activity-pressure risk ratings for bass fishing with nets or lines on habitat features of Welsh MPAs are assessed as Low or not applicable.

Pressure	Risk Rating	Direct or Indirect	Activity inside or outside of sites	Rationale
Abrasion	Medium	Direct	Inside	Anchors and ground ropes could abrade the surface of the seabed.
Penetration	Medium	Direct	Inside	Anchors could penetrate the seabed substrate.
Removal of target species	Medium	Direct	Both	Bass are part of the fish assemblage of the Severn Estuary SAC Estuary feature. The capture of bass by nets or lines, within or outside the site could potentially affect the fish assemblage.

Table 1: Medium risk ratings for bass fishing with nets or lines

If bass fishing using nets or lines occurred over or on the habitat features of Welsh MPAs, abrasion and penetration pressures from ground ropes or anchors will affect the different habitat features to varying degrees. Due to the high level nature of this advice it has not been possible to disaggregate all the habitat features from the indicative risk assessments. However, some habitats such as fragile biogenic reefs or sheltered stable environments are likely to be more sensitive than other more robust habitats or more exposed areas when subjected to abrasion and penetration pressures. This assessment of impact will need to be considered for each individual habitat feature in Welsh Government's statutory environmental assessment processes.

The removal of target species pressure is only relevant inside and outside of the Severn Estuary SAC where bass are part of the fish assemblage of the Severn Estuary

SAC. It is not possible to define the precise area that this pressure applies over in this advice, therefore Welsh Government should consider the mixing and migration of bass between the SAC and wider Bristol Channel.

It should be noted that all indicative Low risk activity-pressure risk ratings from bass fishing with nets or lines could still adversely impact the features of a site when assessed against conservation objectives and should be fully considered by Welsh Government during their statutory environmental assessment processes.

The majority of interactions between static and passive netting gears and benthic habitats are categorised as medium risk by the AWFA Project. Welsh Government have requested NRW complete 75 medium risk netting and benthic habitat fishing assessments within their 23/24 AWFA work plan.

Species features

Table 2 presents the High and Medium risk ratings for species features of Welsh MPAs from bass fishing with nets and lines.

Pressure	Risk Rating	Direct or Indirect	Activity inside or outside of sites	Rationale
Removal of non-target species	High	Both	Both	Bass fishing could lead to the incidental bycatch of mammals (H), fish (H) and birds (M) or their prey
Above water noise	Medium	Direct	Inside	Bass fishing vessels could disturb rafting bird species inside SPAs
Visual disturbance	Medium	Direct	Inside	Bass fishing vessels could disturb rafting bird species inside SPAs

Table 2: High and Medium risk ratings for species features

Removal of non-target species is the only pressure with a High risk rating for bass fishing with nets or lines, and the pressure could affect mobile species wherever they are. The overall High risk rating comprises a High risk ratings for mammals and fish, and a Medium risk rating for birds. Bass fishing with nets or lines has the potential to lead to bycatch or entanglement of mobile species features as well as indirectly removing the prey of mobile species features.

Vessels could potentially disturb mobile species features wherever they are in Welsh waters. The majority of disturbance interactions have been assessed as Low risk or not applicable, however there are two Medium risk ratings from bass fishing with nets or lines for bird features within SPAs, from above water noise and visual disturbance pressures. The Medium risk rating for these pressures relates to the potential for bass fishing with nets or lines to disturb sensitive rafting species such as common scoter or red-throated diver, should fishing occur within SPAs designated for those species.

All other pressures from bass fishing with nets or lines on mobile species were assessed as Low risk or not applicable.

It should be noted that all indicative Low risk pressures from nets or lines could still adversely impact the features a site when assessed against conservation objectives and should be fully considered by WG during their statutory environmental assessment processes.

A number of interactions between static and passive netting gears and mobile species features are categorised as medium risk by the AWFA Project. NRW provided Welsh Government with 9 medium risk fixed netting and marine mammal assessments in 2021 and a further 8 medium risk netting and bird assessments were provided in 2023. Welsh Government have requested NRW complete a further 4 medium risk drift netting and fish species assessments within their 23/24 AWFA work plan.

Wider advice

With respect to the potential effects of bass fishing on GES under the Marine Strategy Regulations (2010) we agree with and sign-post Welsh Government to the NE/JNCC December 2022 FMP GES advice. For the biological diversity (D1) and food webs (D4) descriptor, bycatch of protected mobile species (mammals, birds and fish) is the key impact pathway. However, drivers of pressures often operate at larger scales than single FMPs will manage, therefore an iterative process across FMPs and over several FMP cycles will be required to establish the evidence base and required action. It is also suspected that some species bycatch pressures at a UK level may not be relevant to Wales, but evidence is needed to substantiate this.

Furthermore, the potential effect of bass fishing on the Favourable Conservation Status of Annex 1 habitats outside of sites at a national level should also be considered in relation to Regulation 9 of CHSR 2017.

SSSI’s are intertidal and could be affected by bass fishing activity if it occurs intertidally or from shore.

WFD transitional and coastal waterbodies could also be affected by bass fishing.

Skomer is the only MCZ in Wales. Bass fishing could impact the features of the MCZ and should be assessed by Welsh Government.

Welsh Government have recently announced an MCZ pre-consultation engagement process to select and designate new MCZs in Wales. At some point new MCZ sites may become protected and require assessment and management from potentially damaging activities such as bass fishing.

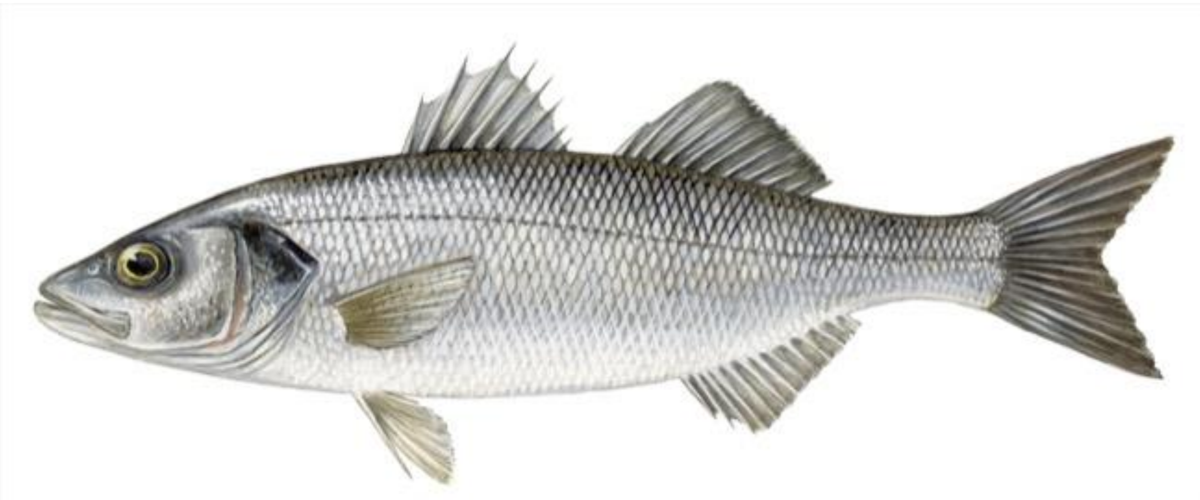
Welsh Government should also consider their duties under the Environment Act (Wales) 2016. These have not been considered within the NE/JNCC advice packages. Section 6 of the Act requires that public authorities must seek to maintain and enhance biodiversity [of the Section 7 habitats and species] so far as consistent with the proper exercise of their functions and in so doing promote the resilience of ecosystems.

Proposed Fisheries Management Plan for Sea bass in English and Welsh Waters

Annex 10: Goals: evidence and stakeholder views

Date: July 2023

Version: public consultation



Contents

Background

'Stakeholder views' in this section are collated from Policy Lab's reports (see FMP Annexes 7-9).

Goal 1: Inclusive stakeholder engagement structures to inform management of the bass fishery

Rationale

The bass stock is a shared national resource which is important to many different stakeholders. Working together collaboratively would help to improve management of the resource for the benefit of all.

Evidence

Participation in fisheries science, management, and governance, involving all interested parties, is increasingly seen as necessary to achieve ocean sustainability (Mackinson & Wilson, 2014). Through the Fisheries Act (2020), Defra is working toward a future vision in which the fishing industry takes more responsibility for managing fisheries sustainably through greater partnership working. Defra-commissioned research concluded that commercial fishers and recreational sea fishers in England wish to have more opportunities to participate in management and science, but also that past and current processes were largely seen as inefficient and disengaging (Reed et al., 2019). However, to implement effective and fair participatory practices in England, it is important that the processes underpinning participation are trusted and allow for collaborative working across interest groups (Wiber et al., 2004). Partnership working, underpinned by shared responsibilities, has wider benefits including more transparent decision-making which can increase trust between interest groups and scientific processes and data. In addition, collaboration can lead to more informed decisions through the integration of a wider set of knowledge and perspectives (Reed et al., 2019; House et al.,2022).

Stakeholder views1

Stakeholders were clear during the co-design process that future management of the bass fishery should be developed using adaptive approaches that bring together fishers, scientists, policymakers, regulators and other stakeholders:

- All nine co-design groups and 58% of survey respondents voted for this approach to monitoring and assessment of the Bass FMP, allowing the group to collectively identify priorities and respond to new opportunities and evidence.
- Many stakeholders stated a preference for holding meetings online to allow for maximum attendance.
- It was noted that selecting appropriate participants and representatives for the group would be crucial to its success- as well as a knowledgeable independent chair who is able to manage differing views.

Goal 2: Equitable access to the commercial bass fishery, while prioritising stock sustainability

Rationale

The existing bass authorisation system has been effective in capping fishing pressure, which has improved sustainability of the bass stock in recent years. However, in the medium-long term the aim should be to deliver the right balance between access to the bass fishery and protecting the stock.

Evidence

Estimated spawning stock biomass has been increasing slightly since 2018, with reasons speculated as a combination of management measures implemented from 2015 and some improved recruitment since 2013 (ICES, 2022b). However, population biomass remains below BPA.

To land bass, a bass authorisation is required and total landings must be kept within allowance limits (Section 7 of FMP). Currently (as of 2023), there are 1040 bass authorisations, with 350 gillnet only, 177 handline only and 513 for both gillnet and hand lines (MMO data). However, over the past 3 years (2020 – 2022) approximately

[1] Stakeholder views' in this section are collated from Policy Lab's reports (see Annexes 7-9)

only 6.8% of this allowance has been used. Therefore, the bass authorisation system could be reviewed in future to reduce latent capacity, whilst also considering how discarding could be reduced for those both with and without a current authorisation

At present, very few vessels are dependent on bass for their primary income. Since 2016, the number of vessels with greater than 60% economic dependence on bass landings has varied between 2-6 vessels.

Stakeholder views

There was general recognition across the commercial sector that while the existing authorisation system had helped to protect bass stocks in recent years by reducing fishing pressure, it was not working perfectly. Issues noted included:

- Those without an existing authorisation felt blocked from entering the lucrative bass fishery and forced to discard their dead bass bycatch.
- Those with an authorisation to fish for bass were generally happy with the current system, but there was also fear that they could lose out if things were rapidly changed due to previous financial investments in vessels with bass authorisations.
- Authorisations for multiple gear types on the same vessel.
- Problems documenting a track record.
- Issues with transferring authorisations between vessels, including with regards to vessel safety.

There were also some suggestions that authorisations could be prioritised for smaller vessels or those that fish in a sustainable manner. However, opinions on how to replace the current authorisation system were divided- six out of nine co-design survey groups abstained on voting for any of the alternatives presented. Environmental representatives also emphasised the importance of not increasing fishing pressure on the still vulnerable stock.

Goal 3: Minimise discarding of bass bycatch where survival rates are low

Rationale

Reduce the waste of dead fish and improve data collection to better manage discarding.

Evidence

Bass discards

Data on bass discard rates are limited due to their collection only during observer programmes that are limited in number and cover a wide range of vessels and the diversity of the fishing fleet. Discard rates are driven by a number of factors, including the proportion of catch comprising bass that can be kept, the relationship between current minimum conservation reference size and gear selectivity (Britton et al 2023).

ICES estimate the discard rate for all commercial fleets at 25% (ICES, 2021). In the UK bass commercial hook and line fishery, a questionnaire survey of practitioners suggested that the mean discard rate is approximately 13% (Lamb et al., 2022). Analysis of Remote Electronic Monitoring (REM) data from three otter trawlers in the Celtic Sea, from October 2020 to August 2021, found bass in 48% of analysed hauls for the five vessels, with an overall discard rate of 57% by weight (Hyder et al, 2022). Data from the Celtic Sea REM programme, in 2022, found a bass discard rate of 44.8% on average for the two participating vessels (Skirrow et al, 2022).

Estimates of the composition of commercial discards are also limited and uncertain. Discards are poorly described in the current stock assessment, which suggests that most discards are below the MCRS. However, initial results using REM from a single otter trawler in the Celtic Sea found that around 90% of sea bass discarded were above the MCRS. It is likely that discards vary among fleets and seasons, and patterns will change as the stock recovers. As a result, more data are needed to accurately capture the magnitude and composition of discards across all fleets for inclusion in the stock assessment and to support management decisions.

Survivability

The health condition of discarded bass at the point of release has been assessed in drift nets, static nets and otter trawls. Fish vitality on release was highest for fish captured in drift nets versus otter trawls, with the lowest values for bass captured in static nets (Randall et al., 2021). This was also reflected in at-vessel mortality rate, the proportion of discarded fish that were dead when returned to sea, where otter trawls resulted in 7% mortality compared with 12% in drift nets and 68% in static nets (Randall et al., 2021). Drift netting has been found to result in fewer injuries than other methods, with almost half of fish having no visible external injury versus approximately 30% in static nets and <10% in otter trawls (Randall et al., 2021).

The condition of fish when released is often not a good predictor of longer-term survival. A study using data storage tags (DST) suggested overall discard survival rates were low for otter trawl and gillnet gears during routine fishing operations, where the precautionary management principle would be an assumption of negligible discard survival (Randall et al., 2021).

A study looking at bass survivability following deployment of very short (max. 200 yard) static nets for very short soak times (average 43 minutes) found a mortality rate of 17%. This was not representative of normal fishing activity but demonstrates how survival rates could be modified. The number of bass caught was relatively high (on average 52% of the total catch) and presence of observers may have biased results by affecting fisher behaviour and handling practices. Of those fish that did survive, acoustic tracking demonstrated at least a 90% survival rate, 7 months post-tagging (Henly & Stewart (2023). For hook and line fisheries, combining a captive experiment of post-release mortality with characteristics of the UK hook and line fleet suggested a UK fleet-wide discard survival rate of 89 % (Lamb et al., 2022).

For sea bass, the main driver of mortality in rod and line caught and released sea bass is from deep hooking, when a fish is hooked in a vital organ past the mouth such as the gills or stomach (Lewin et al., 2018). The risk of this has been much reduced with the use artificial lures compared to bait (Lewin et al., 2018). Air exposure also affects sea bass survival, with mortality after 5 minutes out of water (Lewin et al., 2018). For recreational fishing, post-release mortality is thought to be low (5%) (Lewin et al., 2018). For more information see Britton et al. 2023 (Annex 3).

Selectivity

Hook and line fishing can be highly selective for bass, reducing catch of unwanted species. However, according to one report (Plaster et al., 2022), compared to net caught bass (with mesh sizes of greater than 100mm), a larger proportion (41% compared to 4%) of smaller size class bass (32-42cm) were caught using hook and line methods, though results may differ elsewhere.

In towed gears, changes to the mesh size, especially in the cod end can result in differences in the size of retained fish (Broadhurst et al., 2007). Alterations to twine construction, mesh size, and orientation all affect the selectivity of a trawl, altering the openness or stretched size of the mesh. Selective devices, such as square mesh panels, can be used to take advantage of species-specific behaviour, allowing unwanted fish to escape. It has been found that 80 mm cod ends, as currently permitted by otter trawlers under some conditions and beam trawlers, result in a high retention of immature sea bass as small as 20 cm (Armstrong & Readdy, 2013), but cod end mesh sizes of 100 mm have shown a decrease in retention of sea bass <50 cm (Catchpole, 2011).

A sea bass selectivity trial in the Bristol channel (Catchpole, 2011) showed a square mesh section in the extension piece (placed between headline section and cod end) of an otter trawl was effective in allowing undersized sea bass to escape, and discard rates (fish below MCRS) reduced from 30% to 11%. Reorientating the mesh to 45 degrees from the normal configuration means it stays more open allowing fish to escape. Using an underwater camera, sea bass were seen to make active escape attempts when in the square-mesh section, and small fish were able to escape. This indicated that square mesh sections could be an effective design to improve sea bass selectivity in trawls.

In static nets, changing the mesh size is a reliable way of altering the size of the fish caught, and gillnets have been shown by multiple field studies, to be highly selective for sea bass. Reis & Pawson (1992) showed using catch data that 89 and 92mm mesh retains less than 3% <34 cm and <38 cm fish respectively. Theoretical modelling corroborated that fishing efficiency is highest for 37–40 cm fish using 89-92 mm mesh. In other gill net trials, selectivity was highest for >40 cm fish using 92 mm and larger mesh (Revill et al., 2009), reinforcing the findings from other studies (Reis & Pawson, 1992). According to a recent study by (Plaster et al., 2022), the most frequently caught size class of bass is 42-52cm when using nets with meshes between 100-112mm, with 100mm mesh sizes catching bass of 46cm on average, compared to 105mm mesh sizes catching bass of 49mm on average.

Current regulations mean that there is no targeted gill net or trawl fishery for bass, meaning that nets maybe tuned to catch other species and sea bass is generally encountered as a bycatch. For example, for nets targeting small pelagic species and red mullet, a minimum mesh of 50 mm is permitted. Randall et al. (2021) suggested that interactions between this metier and adult sea bass may occur in winter when sea bass aggregate, but there is no evidence of significant catches with this gear.

Evidence gaps

- Improve data on discard rates for bass.
- More information on the catch patterns of the different gear types is needed (For example by gathering information from skippers), alongside evaluation of the implications for sea bass of new gear-based and spatial technical measures for mixed fisheries.
- Improve data on the survival of fish caught using different gears.

Stakeholder views

There was agreement between stakeholders that no one wanted to see dead fish go to waste. The co-design survey found priorities for this goal included:

- Allowing all fishers to land their bass bycatch where survivability was low (two out of nine co-design groups voted for this, as well as 28% of survey respondents), although stakeholders noted that this could incentivise fishers to target the stock and catch more bass than is sustainable.

- Collecting more data on what was actually being discarded - which would also improve stock assessments and facilitate accurate determinations of sustainable catch limits.
- The use of novel technologies to improve data collection on discarding (four out of nine co-design groups voted for this).

Goal 4: Encourage and facilitate full compliance with bass regulations

Rationale

To ensure that all those fishing for bass understand and comply with the regulations.

Evidence

Addressing issues related to non-compliance is a prerequisite for ocean sustainability (Nielsen, 2003; Oyanedel et al., 2020). Non-compliance risk undermining fisheries management and can result in tensions between resource users, regulators and other interested parties, which in turn can affect stock sustainability and marine ecosystems (Arias, 2015; Cisneros-Montemayor et al., 2013; Lewis, 2015 in Oyanedel et al., 2020). Compliance theory span multiple disciplines including economics, behaviour science, sociology, and criminology in seeking to identify underlying motivations for people to comply or not comply with regulation (Nielsen, 2003; Oyanedel et al., 2020). Other strands of literature have focused on opportunity-based approaches to compliance. Whereas research identifying motivations to compliance focus on the individual actor (fisher, resource user), opportunity-based approaches seek to understand how particular situations create opportunities for non-compliance (Oyanedel et al., 2020). Research also highlights that institutional design and fisheries management arrangements play an important part in compliance (Nielsen, 2003). In fisheries, these arrangements include a diversity of regulations, institutions, informal rules and legal frameworks, which all needs to be considered in addressing compliance issues (Oyanedel et al., 2020).

Stakeholder views

It was suggested that existing bass regulations can be complex and hard for some to understand, particularly when regional byelaws and nursery area legislation are considered. Six out of nine co-design workshops voted to prioritise simplifying regulations, along with 44% of survey respondents. Where simplification is not possible, it was suggested that a targeted communication campaign could improve understanding and compliance with regulations, as well as improved relationships with enforcement bodies who could help to communicate the regulations to fishers. Other key points mentioned included:

- The lack of an agreed definition for ‘unavoidable bycatch’ was noted as a problem for both fishers and enforcement officers.
- Stakeholders were clear that compliance with bass regulations should be a priority for fishery management, and enforcement bodies should collaborate effectively on targeted enforcement.
- There was recognition that existing regulations should be regularly reviewed as part of future iterations of the bass FMP to ensure clarity and purpose.

The merits of a national vs regional approach to management were also discussed. Whilst the benefits of regional regulation were recognised (For example protecting specific local environmental features or industries), generally the benefits of a clear overarching national framework (particularly for understanding and compliance) was prioritised. Four out of nine co-design groups voted for a mostly national, somewhat regional approach, while in the co-design survey 42% of respondents voted for a fully national plan and another 25% for a mostly national, somewhat regional plan.

Goal 5: Maximise the benefits of bass fishing for local coastal communities

Rationale

Bass is particularly important to inshore fishers due to its high market prices, appealing fishing experience for recreational anglers and historical legacy for English and Welsh coastal communities. If managed appropriately, bass fishing therefore has the potential to generate substantial social and economic benefits for local coastal communities.

Evidence

Bass are a relatively high value species, attracting a price per liveweight tonne which, since 2015, has been similar to other high value fishes such as sole and turbot, and is approximately four times higher than demersal species generally captured in bulk by larger vessels offshore, such as cod and haddock. The importance of bass to inshore small scale fisheries fleets means they contribute substantially to local economies (Britton et al. 2023).

Recreational sea fishing is a high participation activity that creates economic impact and social benefits. In the UK, it is estimated that around 772,000 UK adults participated in sea angling each year between 2016 and 2019 (Hyder et al., 2021), creating a total economic impact of £1.6-1.9 billion each year (Hyder et al., 2020). There are both personal and societal benefits derived from sea angling (Armstrong et al., 2013). Personal benefits include relaxation, experiencing nature, physical exercise, personal consumption, and socialising. Benefits to society result from the individual actions of sea anglers, such as health and well-being, environmental improvement, and volunteering.

It is difficult to assess the social and economic benefits of sea angling for sea bass for two reasons. Firstly, it is challenging to partition expenditure by sea anglers between species as, for example, fishing tackle may be used to target several species and not only bass. Secondly, total economic impact studies are of limited use to assess the impact of a change in policy as they do not include individual behaviour changes. A complete cessation of sea angling would likely lead to a partial loss of the total economic impact generated as many anglers would redistribute their spend to other activities. Sea angling in England had a relatively large economic impact compared to its participation rate (Armstrong et al., 2013), so spending on other activities may not offset the economic loss completely. In addition, sea angling generates income in coastal communities, so may be lost to these vulnerable communities if it was spent on non-coastal leisure or sea angling outside of the UK. This makes it difficult to use the economic impact approach to assess the impact of policy, instead stated or revealed preference approaches are usually used for this purpose.

Cevenini et al. (2022) assessed the welfare impact on society of changing sea bass recreational fisheries management using a combination of stock assessment, individual catch data, and estimates of welfare from a recent choice experiment. Highest welfare estimates were found with the lowest levels of restrictions and lowest estimates for a no-take fishery, with a difference of £22 million in estimated economic welfare generated by the recreational sector fishing for the Northern Stock of sea bass between these extremes (Cevenini et al., 2022). This includes social welfare generated by recreational fishers from all countries, so does not relate solely to the UK.

ICES has started developing a catch allocation tool2 for the Northern Stock of bass catches to test management scenarios for commercial and recreational fishing, using ICES sampling recommendations.

[2] GitHub - ices-taf/2019_bss.27.4bc7ad-h_catchAllocationTool-for-2020: The sea bass catch allocation tool was developed to be used exclusively for sea bass (Dicentrarchus labrax) in divisions 4.b–c, 7.a, and 7.d–h (central and southern North Sea, Irish Sea, English Channel, Bristol Channel, and Celtic Sea) in 2020.

Evidence Gaps

- The social and economic importance of inshore artisanal bass fisheries, especially after the first point of sale and their overall contribution to local, regional and national economies.
- Cultural values of commercial and recreational bass fisheries, and the extent to which social links between people and the sea could be affected by the decline or loss of bass fisheries.
- Approaches to maximise the benefits to coastal communities from bass.

Stakeholder views

Commercial and recreational fishers had sometimes contrasting views on the benefits of bass fishing (For example commercial fishers emphasised their livelihoods depending on catching bass, as well as contributions to national GDP and food security- while recreational fishers pointed to catching bass for personal consumption as well as the economic contributions from charter boats, tackle shops, tourism and personal mental health benefits). There was agreement, however, that:

- Benefits to local coastal communities, which encompass both recreational and commercial communities as well as the wider economy, ecosystem and cultural heritage, should be prioritised in the Bass FMP (7 out of 9 workshops and 29% of survey respondents voted for this).
- Fishing opportunities should be allocated to the recreational and commercial sectors according to the benefits they generate (48% of survey respondents voted for this).
- ‘Benefits’ should be viewed holistically, including benefits to the local environment, health and community cohesion as well as just economics.
- Evidence to support many of the benefits was currently lacking.

Goal 6: Sustainable harvesting of the bass stock in line with scientific advice

Rationale

The primary aim of FMPs is to ensure that the stocks in scope are harvested sustainably. Since the introduction of the current management approach in 2015, harvesting of the bass stock has been maintained within sustainable limits aligned with ICES advice. In future, it may be possible to build on this foundation to enhance the potential benefits from bass fishing by exploring alternative harvest strategies in line with other FMP goals. A co-ordinated international approach has been required since 2015 to promote the recovery of the Northern bass stock, so may also be necessary to ensure UK fishers achieve the full benefits of any alternative harvest strategy.

Evidence

Existing management

In response to the rapid decline in the Northern stock bass population between 2009-2018 (ICES 2022b), management measures were implemented in 2015 to reduce fishing exploitation rate with the aim to increase the biomass of the population. An increase in biomass has been observed since 2018, which is likely to have resulted from these management measures, as well as an increase in recruitment levels of the population, but remains below MSY $B_{trigger}$ [3]and between B_{pa}[4] and B_{lim}[5].

Maximum Sustainable Yield

Maximum Sustainable Yield (MSY) is the largest average catch that can theoretically be taken from a species' stock, if environmental conditions remain constant, without threatening future yields. MSY is achieved when the population size is at the point of maximum growth rate. If the population size reduces, due to fishing or natural mortality, and goes below the biomass level required to maintain MSY (B_{MSY}), there will then be insufficient reproductive capacity of the stock to sustain the fishery. To maintain the population size above B_{MSY}, the fishing exploitation rate (F_{MSY}) must be managed.

The minimum biomass of the population (B_{MSY}) and the fishing rate (F_{MSY}) to maintain MSY are calculated by ICES. For the Northern Stock of bass, these reference points were defined in 2018 (ICES, 2018) and updated in 2019 (ICES, 2022a, Table 1). ICES consider bass a Category 1 stock, meaning it is a data rich

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3 **MSY $B_{trigger}$** - Seen as the lowest point of natural stock fluctuation around BMSY. If SSB falls below this reference point it triggers a cautious response and a reduction in the advised catch for that stock.

4 **B_{pa}** - If SSB falls below this reference point the population may be unable to replenish itself and will be at high risk for decline, so a reduction in catch for that stock will be advised. This reference point is designed to build in a safety margin limiting the effects of data uncertainty when exact biomass cannot be estimated.

5 **B_{lim}** - SSB is lower still than MSY $B_{trigger}$. If SSB falls below this reference point, there will be a high risk of the number of fish entering the spawning stock will be impaired. meaning the stock size will likely decline over time as it is unable to replenish itself.

stock, and a full analytical assessment is conducted, and a range of catch scenarios are provided. These calculations are modelled based on data on commercial landings and discards, recreational catch, and independent survey data. However, although considered a data rich stock, information is still currently lacking on accurate discard information and recreational removals, which along with unknowns around the mixing of different populations adds to the uncertainty of calculating these reference points.

Table 1. Reference points used in the sea bass assessment (ICES, 2022a).

Reference points	Value
Precautionary Approach:	
• B_{lim}	10313 tonnes
• B_{pa}	14439 tonnes
• F_{lim}	0.254
• F_{pa}	0.203
MSY Approach:	
• F_{MSY}	0.1713
• $F_{MSY\ lower}$	0.142
• $F_{MSY\ upper}$	0.1713
• MSY $B_{trigger}$	14439 tonnes

Alternative approaches

Maximum Economic Yield (MEY) is the value of the largest positive difference between total revenues and total cost of fishing. MEY is typically achieved at catches that are 10-20% smaller than MSY. Fishing effort is reduced in comparison to achieving MSY, therefore reducing costs, and increasing biomass of the population.

Large Stock Strategy (LSS) is an approach which aims to increase the proportion of large fish within the population and is favoured by the recreational sector. To achieve LSS, fishing pressure would need to reduce in general, and there would need to be increased selectivity to reduce capture of the largest individuals.

Maximum Societal Benefits is the total economic and social value derived by people from the bass resource, which includes use, non-use, option, and bequest values.

This is related to the ecosystem services provided and the benefits that these services generate for society.

Evidence gaps

- An accurate measure of bass discard rates to feed into stock assessment models.
- Improved data on recreational removals to feed into stock assessment models.
- A better understanding of stock mixing, and the impacts to stock assessment models.
- An understanding of the benefits and limitations of different management approaches that prioritise societal and ecosystem benefits.
- The role of recruitment and year class strength on spawning stock biomass recovery versus different management actions.
- A fishery independent survey of the stock and distribution of adults over time.

Stakeholder views

There was a consensus among stakeholders that:

- 'Free-for-all' harvesting of the bass stock would be detrimental.
- Harvest strategies should be science-led.
- Improving the evidence base to support accurate stock assessments should be a priority.

However, opinion was divided over which harvest approach to take:

- Six out of nine co-design workshops voted for a strategy that prioritises long-term societal benefits, while only 18% of co-design survey respondents voted for this option.
- 35% of survey respondents voted for MSY.
- 35% opted for an approach that prioritises conservation and the wider ecosystem.

It was generally agreed that more evidence was needed to determine which harvest strategy could achieve the ideal balance between biological, environmental, social and economic sustainability- and what this might look like in practice. Stakeholders were clear that alternative harvest strategies should be co-developed in collaboration with scientists and policymakers as more evidence is generated.

Goal 7: Ongoing protection of the juvenile and spawning bass stock

Rationale

Although the bass stock has shown signs of recovery in recent years, spawning stock biomass (SSB) and the recruitment of juveniles remains low. Effective protection of the spawning and juvenile bass stock will enable to stock to replenish most efficiently.

Evidence:

In general, 50 % of females are mature at 41 cm (age three to six years, depending on location/growth conditions in early life) and males at 35 cm (Pawson and Pickett, 1996). Bass currently have a minimum conservation reference size (MCRS) of 42cm, to enable individuals to reach maturity and have the opportunity to spawn before risk of capture. The largest and oldest fish within a population, are likely to disproportionately contribute to the spawning potential of a stock compared to the amount they contribute to the spawning stock biomass, as they spawn for a longer period, have larger egg production and higher quality eggs (For example , Hixon et al., 2014). Introducing slots limits (upper and lower size limits) are one method to limit the fishing mortality on these large individuals. Initial results based on adapting the assessment suggest that slot limits would be of limited benefit to the bass population, as to achieve a noticeable reduction in fishing mortality, a slot limit of 60-65cm would be required, which would considerably reduce catch, likely increase discards and provide a limited impact on the state of the stock (Hyder et al., 2022). However, further modelling is needed to assess slot limits comprehensively using a different approach that accounts for changes in reproductive potential and stock recruitment relationship (Hyder et al., 2022).

Protected areas can also lead to protection of the spawning bass stock. Marine Protected Areas with No Take Zones have been shown to have a positive influence on bass abundance and size (Garcia-Rubies *et al.,* 2013, Jouvenel and Pollard, 2001).

Protection of juveniles

Inshore and estuarine habitats provide critical feeding and refuge habitats for juvenile bass, particularly salt marshes which provide food supply, refuge, and protection from predators (Fonesca et al. 2022). In Britain, it is considered that all estuaries south of 54ºN have the potential to act as nurseries for bass, with 37 estuaries and coastal areas in England and Wales designated as Bass Nursery Areas (BNAs) since the 1990s (Hyder et al., 2018). BNAs are thought to have played an important role in protecting the stock, possibly generating changes in size distribution, increased juvenile survival, and improvements in the productivity of the stock (Hyder et al., 2018). However, it is very challenging to estimate the impact of BNAs on the stock in a meaningful manner, as it involves knowing the relative contribution of individual nursery areas to the adult stock and density dependent mechanisms that could reduce the survival on nursery grounds (Hyder et al., 2018).

Recruitment success is driven primarily by environmental factors with the relationship between spawning stock biomass and recruitment being relatively weak (see Britton et al 2023, and references therein). Larval dispersal is driven mainly by the influence of wind on residual currents and sea temperature, where stronger currents increased larval drift distances and higher temperatures reduced the length of the pelagic phase (Beraud *et al.,* 2018, Graham et al., 2022). The relative importance of different environmental factors has been shown to differ at a local scale (Martinho et al., 2009; Vinagre et al., 2009; Bento et al., 2016; Watson et al., *in review*). For more information see Britton et al. 2023 (Annex 3).

Evidence gaps

- Understand the extent of philopatry in adults to specific spawning areas and the processes involved in this philopatry.
- Understand the larval dispersal dynamics and mixing events, and the extent to which post-larval settlement into specific nursery areas is driven by spawning in different spatial areas.
- Understand the relative contribution of individual nursery areas to the stock .
- Understand the relationship between environmental factors on the recruitment of juveniles to the bass stock
- Quantify whether differences occur between regional spawning periods, and the impacts on the population.
- Understand the regional and interannual variations in bass abundance in nursery areas.
- Better quantify the benefits and limitations different size management measures.
- Understand the potential to improve selectivity and survivability from different gears.

Stakeholder views

There was a broad consensus among stakeholders that:

- Existing management measures have successfully helped the bass stock recover in recent years, although some recreational fishers believe stock levels remain too low and there are not enough larger fish.
- It is necessary for policymakers, regulators and stakeholders to work closely with scientists, to determine appropriate size limits (For example the MCRS and/or slot sizes) to address the age/size structure of the stock.
- Real-time local fishery closures to protect the spawning bass stock could be beneficial, although it was acknowledged more evidence is needed to support this approach.
- Closed seasons to protect spawning bass aggregations are beneficial (five out of nine co-design survey groups and 41% of survey respondents voted in favour of this approach).

While stakeholders noted that bass spawn at different times around England and Wales, there was agreement that many different regional closed seasons would complicate regulations, potentially compromising compliance.

Goal 8: Minimise the impact of bass fishing on the wider marine ecosystem

Rationale

A thriving fishing industry is underpinned by a healthy marine environment (JFS 2022) and the government is committed to an ecosystem approach to fisheries management which will account for, and seek to minimise, impacts on non-commercial species and the marine environment generally (25 YEP, JFS 2022)**.** The Ecosystem Objective of the Fisheries Act (2020) further articulates that an ecosystem-based approach to fisheries management is an approach which: (a) ensures that the collective pressure of human activities is kept within levels compatible with the achievement of good environmental status (within the meaning of the Marine Strategy Regulations 2010 (S.I. 2010/1627)), and (b) which does not compromise the capacity of marine ecosystems to respond to human-induced changes. Conservation advice provided by SNCB's (Annex 12) considered risks to designated highly mobile species outside of MPA boundaries and risks to UK MS descriptors arising from fisheries contained in FMPs. That advice, as well as stakeholder and Defra priorities have informed the goals identified in the following section.

Stakeholder views

There was general agreement across all sectors that the impact of bass fishing on the wider environment should be minimised. However:

- Commercial fishers noted that additional gear restrictions could compromise their economic sustainability.
- Six out of nine co-design groups and 61% of co-design survey respondents voted to prioritise the use of more sustainable gear types in the Bass FMP.
- There was some disagreement over which gears were considered more sustainable, although many fishers stated they were already choosing to use more sustainable gears to fish for bass.
- The use of novel technologies was chosen by four out of nine co-design workshops as an effective way to manage bycatch, including suggestions for smarter tracking devices and sonic/light solutions to avoid other species.

Bycatch of Endangered, Threatened and Protected species in bass fisheries

Rationale

The ecosystem objective in the Fisheries Act 2020 states that "incidental catches of sensitive species is minimised and, where possible, eliminated", while the UK Bycatch Mitigation Initiative sets out in more detail policy objectives and actions required to meet the ecosystem objective. Certain segments of the bass fishery, in particular the use of nets, present a bycatch risk to species including seabirds, marine mammals, elasmobranchs (sharks, skates and rays), turtles and migratory fish (including salmon, allis shad and twaite shad). Some of these species are features of MPAs, whose protection extends beyond site boundaries; others have population targets associated with the UK Marine Strategy, others have international protections or population targets.

Evidence

There is no available evidence which suggests typical UK hook and line fisheries cause bycatch or habitat damage which may negatively impact sensitive species (such as sensitive fish species, elasmobranchs, seabirds and marine mammals). This is due to a greatly reduced risk of interaction with this highly selective gear type.

Mixed fisheries using bottom towed gears capture a proportionally smaller share of UK landed bass than other gear types. Although sensitive cetacean and bird species are able to evade capture or harm from mobile gears, further evidence is required to understand the risk posed by such gear to Shad and elasmobranch species.

Fixed/static net fisheries (gillnets, tangle and trammel nets) are a high bycatch risk to a range of marine sensitive species (some of which are designated features of MPAs but occur outside MPA sites). When using static nets, there is the potential to catch other fish species as well as bass, and netting is thought to pose a significant risk to Atlantic salmon, allis shad and twaite shad, that spend some of their life cycle in coastal waters in similar locations to bass. The risk that static nets can pose to Atlantic salmon is well known. For example, preliminary data from the Salmonid Management Around the Channel (SAMARCH) project found 11 salmon were caught in three 200m long gillnets off southern Cornwall (Environment Agency 2021). Waugh (2004) reported drift and static nets to be the most common method used by illegal poachers to capture salmon in the Thames Estuary. A review of vulnerable species bycatch by Northridge et al. (2011) noted 190 shad in static gear caught between 1999 and 2009 from a total of 1,698 hauls. However, as this was from surveys focused mainly on cetaceans and not optimised for other taxonomic groups, the data were not extrapolated across the fleet as estimates would not be robust. A CEFAS observer programme report (2015; *unpublished*) reported more bycatch in the south/southwest with a particular hotspot in the southwest for allis shad**.**

Static/ Fixed net fishing is likely to catch a range of fish species, however the species composition can vary through altering the mesh size of the net in different areas (Plaster et al., 2022).

It is well recognised that static (gillnet) net fisheries can pose a bycatch risk to seabirds. There are seven bird species that are associated with SPAs (Great Northern Diver, Gannet, Shag, Guillemot, Razorbill, Northern Fulmar and Great Cormorant) where overall bycatch from static nets is predicted to exceed 1% of adult mortality. This does not necessarily translate to a risk to SPA conservation objectives and the proportion that is relevant to nets catching bass is not known (Northridge et al. 2020, Miles et al. 2020).

Static nets also pose a risk to marine mammals. Using point estimates, of the 883 harbour porpoises thought to have been caught as bycatch in 2019, 275 were estimated to have been caught by the type of light gillnet which is associated with commercial bass netting. Spatially, most Harbour Porpoise were caught in ICES division 7e (304), 7d (199) and 7f (183) in the English Channel & Celtic Sea, and 4c (92) in the Southern North Sea (Kingston et al. 2021). Risk mapping has highlighted that the use of gillnets in the eastern part of the English Channel (year-round) and the western Channel (between July and September) as relatively high risk to harbour porpoise (Evans et al. 2021). Harbour porpoise bycatch in nets is currently of a scale that could threaten Good Environmental Status (GES) targets under the UK Marine Strategy. In addition, several hundred common dolphin are estimated to be bycaught in nets each year, but it is not yet possible to determine how much of a threat this poses to GES targets for D1 D4 Cetaceans. Estimates of bycatch of bottlenose dolphin are not available, but concern has been raised on the levels of bycatch in the south-west.

There is also a risk to seals from static nets. The 2019 Bycatch monitoring programme (Kingston et al. 2021) report estimated that in that year, 488 seals (both grey and common) were caught in gill nets. 90% of this is thought to occur in tangle / trammel nets. For the light gillnets typically used for small species including bass, the point estimate of bycatch is zero. However, considering the 95% upper confidence limit range (a bycatch of 90 seals), it would suggest there is potentially some low levels of bycatch occurring.

A number of sharks, skates and ray species are highly vulnerable to bycatch, in particular from static nets (Bendall and Hetherington 2021). These species are of particular conservation concern due to their slow growth, late maturity and behavioural traits, such as forming large aggregations and segregating by size or sex.

Evidence gaps

- Robust bycatch and monitoring and reporting regimes at temporal and spatial resolutions capable of informing the development of management, with specific gaps around:
    - Bycatch risk of bass fisheries to salmon, twaite shad and allis shad
    - Bycatch risk of bass fisheries to elasmobranchs
- Improved estimates of effort, including spatial and temporal patterns, (especially for <12m vessels and static gear) of the bass fishery, to improve estimates of the bycatch risk to seabirds and marine mammals.
- Understanding the effectiveness and practicality of bycatch mitigation methods for sensitive species in bass fisheries.
- Interactions between seal and bass populations

Impacts of gear on seabed integrity

Rationale

Demersal trawls and dredges present the most risk to seabed integrity and benthic habitats. However, while some bass continues to be landed by mobile gear (as a bycatch allowance), these gears are not currently permitted to target bass.

Evidence

Bottom trawling causes physical disruption of the seabed through contact of the gear components with the seafloor and can also result in the resuspension of sediment into the water column in the turbulent wake of the gear. Pressures associated with trawling include abrasion and penetration of the seabed, and damage to organisms living on and in the habitat , removal of species and smothering and siltation (Cantrell et al. 2023 and references therein).   The number of organisms can decrease by up to 90% following a single pass of a demersal trawl (Cook et al. 2013). These losses can result in a change in community structure and an overall loss of biodiversity (Jennings and Kaiser, 1998; Hinz et al. 2009; Olsgard et al. 2008). The magnitude of the impact is determined by the speed of towing, the physical dimensions and weight of the gear, the type of sediment and the strength of the currents in the area fished (Jennings and Kaiser, 1998). On sandy or muddy surfaces, bottom trawling resuspends sediments causing siltation and reduced visibility (FAO, 2021; Jennings and Kaiser, 1998), as well as lowering the nutritional quality of the sediment (Chuenpagdee et al. 2003). The effects of bottom trawls are also dependant on the natural variability of the region, with effects lasting only for a few hours in shallow, turbulent waters where natural disturbance is high, but up to decades in deep, stable environments (Jennings and Kaiser, 1998; Jennings et al 2001). Bottom trawl fisheries could also have detrimental impacts on releasing carbon and pollutants such as PCBs and heavy metals trapped into the seabed through resuspension of sediment, increasing carbon emissions into the water column and potentially resulting in the release of $CO2$ to the atmosphere (Cavan and Hill, 2021; Pusceddu et al. 2014).

As set gillnets are static, the area affected is less compared to mobile gear (Jennings and Kaiser, 1998). However, in strong currents or during hauling, gillnets can become tangled on the seabed and organisms (Chuenpagdee et al. 2003). In English waters, such impacts are assessed and where necessary managed by IFCAs and the MMO inside MPAs, and outside MPAS gillnetting is not thought to contribute significantly to the UK’s failure to meet UK Marine Strategy targets for seafloor integrity. Hook and line fishing methods are not currently thought to contribute to failures to reach GES for seafloor integrity. In Wales, the FMP programme is being used to prioritise and deliver Assessing Welsh Fishing Activities (AWFA) Project assessments undertaken by Natural Resources Wales. The completed assessments will be used to develop and implement any necessary management measures on a prioritised basis.

Marine Litter

Abandoned, lost, or discarded fishing gear is associated with sensitive species entanglements and ghost fishing.

Evidence

The risk of losing static fishing gear is significantly greater than the risk of losing mobile gear. Gillnets are one of the most common gear types lost, resulting in ghost fishing (Suuronen et al. 2012; Macfadyen et al. 2009). Approximately 5.8% of complete gillnets are lost annually (Richardson et al. 2019) and retain the ability to catch fish and other species (Macfadyen et al. 2009). The rate of continuous fishing by lost gillnets depends on the maintenance of a vertical profile in the water column and the visibility of the net (Chuenpagdee et al. 2003). The level of ecological impact will likely vary spatially and be dependent on the species present, their abundance and vulnerability.

Goal 9: Mitigate against and adapt to the impact of climate change on bass fishing

Evidence

Impact of Climate Change on bass populations

The bass lifecycle is strongly temperature dependent, especially their early life-stages (Bento *et al.,* 2016). Consequently, it can be assumed that climate warming would strongly influence aspects of their biology and physiology, distribution, and abundance. The influence of climate change on the marine environment is relatively complex, where marine fauna must respond to changes involving the interactions of, for example, warming temperatures, increasing ocean acidification, and altered salinity patterns, along with sea level rises in inshore and especially estuarine areas, including during episodic storm surges (Gissi et al. 2021).

The responses (and thus measurements of resilience) of bass to aspects of climate change have been assessed on a wide range of biological and physiological metrics, with many responses suggesting bass populations have some inherent resilience to changing climatic conditions. Temperature is an important driver of recruitment and growth (Pinto *et al.,* 2021) and a positive relationship has been found between summer sea temperature and recruitment strength (For example Kennedy and Fitzmaurice, 1972), with increased summer growth subsequently enhancing overwinter survival (Pickett and Pawson 1994). From an ecological perspective, the combination of ocean acidification and warming are suggested as potentially decreasing the recruitment of bass larvae to nursery areas, but once in nursery areas, juveniles might then benefit from increased performance under elevated temperatures (Howald *et al.,* 2022). However, prolonged periods of extreme heat could have negative effects on bass biology and metabolic ecology in estuarine nurseries (Vinagre *et al.,* 2012b). For more information see Britton et al. 2023 (Annex 3).

Under future climate change, modification of temperature and salinity are expected to result in shifts to distributions of marine organisms, including commercial fish species (Townhill et al, 2018). Townhill et al. (2018) predicted future habitat suitability increases northwards for bass of 27-51% within the UK EEZ by 2040, and 25-100% by 2060, depending on the climate prediction model used.

Climate change mitigation – reaching Net Zero

Bass are primarily caught by the <10m fishing fleet, with approximately two thirds (60-66%) of all landings liveweight caught with hook and lines. Static nets have accounted for 29-32% of UK vessel landings, followed by a small percentage of otter trawls and beam trawls.

Recent analysis has shown that the total <10m UK fishing fleet segment using hooks (including long line fisheries as well as handlines), which comprises of 188 vessels produced approximately <0.5% (3221t CO_2e) of the total carbon emissions at sea each year across the UK's fishing fleets. Less than 10m drift and fixed net fisheries (209 vessels), produced approximately <1% (5400t CO_2e), and <10m demersal trawls and seines (176 vessels) produced approximately 1.3% (10947kt CO_2e). Whilst passive gears are generally less emission-intensive than mobile gears, quantification of carbon emissions across the fishing fleet supply chain (for example, preharvest through to postharvest) is required to truly understand the fisheries carbon footprint (Engelhard et al., 2022).   There are currently no data on the carbon emissions of the recreational bass fishery.

Climate change mitigation – blue carbon

Healthy coastal and marine environments can provide nature-based solutions to help tackle climate change. For example, certain marine habitats that are home to juvenile bass, such as saltmarsh and seagrass habitats, are able to capture and store carbon and therefore these are known as blue carbon habitats. If left undisturbed, these habitats can contribute to GHG emissions reductions. Habitat disturbance through fishing practices may affect seabed carbon dynamics.

The sea holds both sequestered carbon (for the long term) and stored carbon (for the short to medium term) in a system termed the Marine Carbon Cycle. Fish are thought to play an important role in the marine carbon cycle, but their importance relative to the rest of the carbon cycle is yet to be determined. In the short term, whilst alive they store carbon in their tissues, known as biomass carbon, with larger individuals able to store more carbon. They also export carbon to the deep sea with the potential for long term sequestration through the sinking of their excreted faecal pellets, and from sinking of their deadfall carcasses. Evidence is beginning to suggest that overfishing reduces the carbon storage potential of the ocean not only through removal of biomass, but by reducing the mean size of individuals in the population, the quantity of faecal pellets excreted and the number of large carcasses sinking to the seabed. Evidence is emerging that indicates that fisheries management could play a positive role in the marine carbon cycle through preserving the largest fish within populations, maintaining sustainable stocks beyond MSY limits and adopting Ecosystem Based Fisheries Management (Hickman et al, 2023). As further research develops in this area, it will be considered for future iterations of the FMP.

Evidence gaps

- The impact of climate change on northern bass stocks, including on their growth, body sizes and condition, distribution, abundance, and capture vulnerability
- The impact of climate change on the bass fishery.
- Calculate the carbon footprint of the bass fishery and assess how it could be reduced

Stakeholder views

Stakeholders were concerned that climate change could impact bass stocks in English and Welsh waters, with some already noticing bass appearing further north than previously- possibly in response to ocean warming. However, understanding of the future impact of climate change on stocks was limited. It was also highlighted by stakeholders that fisheries management must have the flexibility to respond rapidly in future as stocks are impacted and evidence evolves. As discussed in Goal 3, stakeholders generally agreed that it was important to minimise the impact of bass fishing on the wider environment- including climate impacts.

Department for Environment Food & Rural Affairs

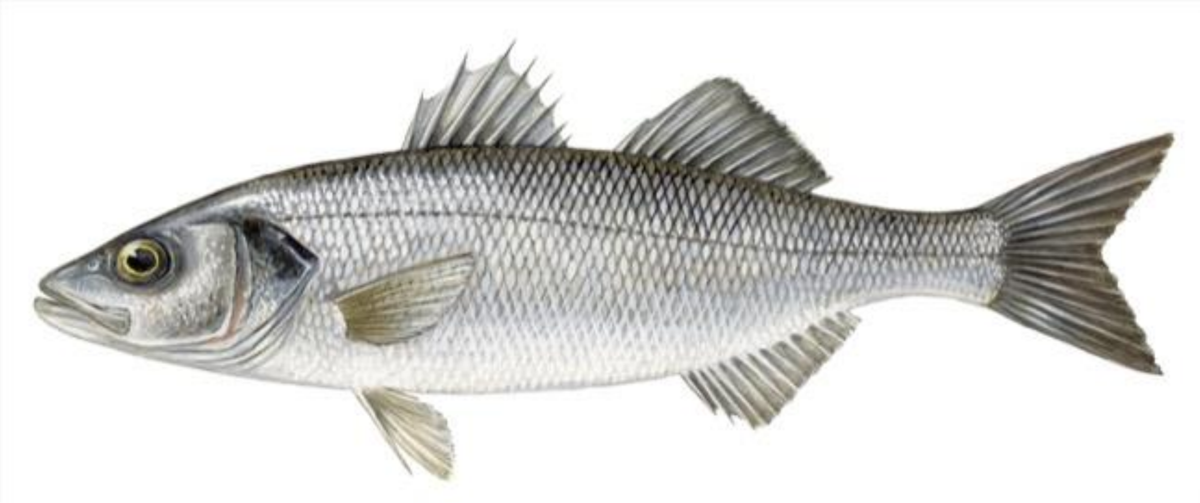
Llywodraeth Cymru
Welsh Government

Proposed Fisheries Management Plan for Sea bass in English and Welsh Waters

Annex 11: England and Wales byelaws relating to the management of bass

Date: July 2023

Version: public consultation



Introduction

This document has been prepared by the Association of IFCAs with input from the 10 regional IFCAs and Welsh Government. The aim is to present a summary of English and Welsh inshore fishing management measures related to the capture of bass (*Dicentrarchus labrax*), or gear types that could potentially capture bass and therefore contribute to the management of this species.

The Association of IFCAs and Welsh Government have used their discretion in identifying specific measures from individual byelaws to be included in this summary. Full Byelaw details are available on the regional IFCAs and Welsh Government websites, links to which are included at the top of each section. In identifying the spatial areas relating to specific measures, reference is made to the UK Fishing Restrictions from Kingfisher website (https://kingfisherrestrictions.org) and the individual area codes used on that site to aid in the communication of spatial data. Where area codes were not available, a summary description of the applicable area has been included. Temporal limits to management measures are expressed as seasonality by month. Best efforts have also been made to express each measures applicability to both recreational and commercial fishing activities.

This document is not exhaustive and does not capture the nuanced complexity of inshore fisheries management. Likewise, inshore fisheries management is constantly evolving, and new byelaws are currently in various stages of development. The byelaws included here were correct as of March 2023. This document is intended to offer an aid memoire and summary of key management relevant to this FMP so as to foster further dialogue between stakeholders and regulators.

Version 1

Contents

Northumberland IFCA Byelaws

https://nifca.gov.uk/wp-content/uploads/2022/11/FULL-BYELAWS-October-2022.pdf

Trawling Byelaw

Prohibition on use of trawls

Area – NIFCA District

Commercial – Yes

Recreational – Yes

Exceptions apply

Permit required to trawl

Area – NIFCA District

Commercial – Yes

Recreational – No

Permit charge applies

Maximum vessel length 12m

Area – NIFCA District (0-3 nautical mile zone)

Commercial – Yes

Recreational – No

Maximum vessel length 18.3m

Area – NIFCA District (3-6 nautical mile zone)

Commercial – Yes

Recreational – No

Exemption required for Coquet to St Mary’s MCZ

Area – Seafish Kingfisher fishing restrictions map area: 2117

Commercial – Yes

Recreational – No

Gear restrictions apply

Area – NIFCA District

Commercial – Yes

Recreational – No

Monthly catch and effort returns required

Area – NIFCA District

Commercial – Yes

Recreational – No

Minimum Sizes Byelaw

Species MCRS – Bass (*Dicentrarchus labrax*) – 42cm

Area – NIFCA district

Commercial – Yes

Recreational – Yes

Marking of Fishing Gear and Keep Boxes Byelaw

Marking of passive gear required

Area – NIFCA district

Commercial – Yes

Recreational – Yes

Fixed Engine Byelaw

Prohibition on use of fixed nets

Area – Seafish Kingfisher fishing restrictions map area: 1656

Commercial – Yes

Recreational – Yes

Exceptions apply

Seasonal fixed net prohibitions

Area – Seafish Kingfisher fishing restrictions map areas: 1659, 1660, 1661

Seasonality – March to October

Commercial – Yes

Recreational – Yes

Exceptions apply

Seasonal headline clearance restrictions

Area – NIFCA District

Seasonality – March to October, January to February

Commercial – Yes

Recreational – Yes

Exceptions apply

Prohibition of the use of Mobile Fishing Gear within the English section of the Berwickshire and North Northumberland Coast Special Area of Conservation (SAC)

Prohibition on use of trawls

Area – Seafish Kingfisher fishing restrictions map area: 1700

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

Exceptions apply

Authorisation required to trawl

Area – Seafish Kingfisher fishing restrictions map areas: 1662, 1663, 1664

Commercial – Yes

Recreational – Yes

Gear restrictions apply

Area – Seafish Kingfisher fishing restrictions map areas: 1700, 1662, 1663, 1664

Commercial – Yes

Recreational – Yes

Seagrass Protection Byelaw within the English section of the Berwickshire and North Northumberland Coast Special Area of Conservation (SAC)

Prohibition on removal of sea fisheries resources

Area – Seafish Kingfisher fishing restrictions map area: 1665

Commercial – Yes

Recreational – Yes

Exceptions apply

North Eastern IFCA Byelaws

Byelaws : North Eastern IFCA (ne-ifca.gov.uk)

Trawling: Prohibitions: Exceptions 2003

Permit required for trawling

Area – NEIFCA District

Commercial – Yes

Recreational – Yes

Permit charge applies

Maximum vessel length – 18.3m

Area – NEIFCA District

Commercial – Yes

Recreational – Yes

Sunset list for vessels up to 28m

Maximum engine power – 400kw

Area – NEIFCA District

Commercial – Yes

Recreational – Yes

Trawl must be raised and cleared once every three hours

Area – NEIFCA District

Commercial – Yes

Recreational – Yes

Spatial restrictions

Area – Seafish Kingfisher fishing restrictions map area: 2003

Commercial – Yes

Recreational – Yes

Humber Estuary Fishing Byelaw

Permit required for trawling

Area – Humber Estuary

Commercial – Yes

Recreational – Yes

Permit charge applies

Prohibition on removal of sea fisheries resources

Area – Spurn Point Seagrass Area

Commercial – Yes

Recreational – Yes

Exception for fishing with rod and line

Maximum vessel length – 18.3m

Area – Humber Estuary

Commercial – Yes

Recreational – Yes

Maximum engine power – 400kw

Area – Humber Estuary

Commercial – Yes

Recreational – Yes

Technical Gear restrictions apply

Area – Humber Estuary

Commercial – Yes

Recreational – Yes

Fish, Mollusc and Crustacea Minimum Size Byelaw

Species MCRS – Bass (*Dicentrarchus labrax*) – 42cm

Area – NEIFCA district

Commercial – Yes

Recreational – Yes

Fixed Engine Byelaw

All fixed netting prohibited

Area – Seafish Kingfisher fishing restrictions map area: 2034, 2035

Commercial – Yes

Recreational – Yes

Permit required for intertidal and subtidal fixed netting

Area – Seafish Kingfisher fishing restrictions map area: 2036

Seasonality – October to June

Commercial – Yes

Recreational – Yes

Technical gear restrictions, vessel size and net tagging requirements apply

All fixed netting prohibited

Area – Seafish Kingfisher fishing restrictions map area: 2037

Seasonality – March to September

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

Nets must be checked once every 24 hours

Area – NEIFCA District

Commercial – Yes

Recreational – Yes

Requirement for surface marking of nets

Area – NEIFCA District

Commercial – Yes

Recreational – Yes

Minimum clearance of headrope 4m at any state of tide

Area – NEIFCA District

Commercial – Yes

Recreational – Yes

Minimum water depth of 5m at any state of tide

Area – NEIFCA District

Seasonality – November to March

Commercial – Yes

Recreational – Yes

Minimum water depth of 5m at any state of tide

Area – NEIFCA District

Seasonality – March to October

Commercial – Yes

Annex 11 Byelaws relating to the management of bass

Recreational – Yes

Minimum water depth of 10m at any state of tide

Area – NEIFCA District

Seasonality – March to October

Commercial – Yes

Recreational – Yes

Minimum water depth of 5m at any state of tide

Area – NEIFCA District

Seasonality – March to October

Commercial – Yes

Recreational – Yes

Maximum net length of 100m for non-registered fishing vessels

Area – NEIFCA District

Commercial – No

Recreational – Yes

Seine Net, Draw Net or ‘Snurrevaad’ Byelaw

Prohibition on use

Area – NEIFCA District

Commercial – Yes

Recreational – Yes

Flamborough Head Fishing Byelaw

Prohibition on trawling

Area – Seafish Kingfisher fishing restrictions map area: 2024

Commercial – Yes

Recreational – Yes

Permit required for trawling

Area – Seafish Kingfisher fishing restrictions map area: 2025

Commercial – Yes

Recreational – No

Does not permit beam or multi-rig trawling

Flamborough Head No Take Zone Byelaw

Prohibition on removal of sea fisheries resources

Area – Seafish Kingfisher fishing restrictions map area: 2026

Commercial – Yes

Recreational – Yes

Eastern IFCA

[Regulations - Eastern IFCA (eastern-ifca.gov.uk)](eastern-ifca.gov.uk)

Minimum Size Byelaw 2019

Species MCRS – Bass (*Dicentrarchus labrax*) – 42cm

Area – EIFCA district

Commercial – Yes

Recreational – Yes

Fixed Engines; Authorisation of Placing Byelaw

Prohibition on use of fixed engines

Area – Seafish Kingfisher fishing restrictions map area: 2108

Commercial – Yes

Recreational – Yes

Kent and Essex IFCA

[KEIFCA District Byelaws - Kent & Essex IFCA (kentandessex-ifca.gov.uk)](kentandessex-ifca.gov.uk)

Minimum Sizes Byelaw

Species MCRS – Bass (*Dicentrarchus labrax*) – 42cm

Area – K&EIFCA District

Commercial – Yes

Recreational – Yes

Vessel Length and Engine Power Byelaw

Prohibition on using fishing vessels over 14m OAL

Area – K&EIFCA District

Commercial – Yes

Recreational – No

Prohibition on using fishing vessels with engine power over 221 kilowatts

Area – K&EIFCA District

Commercial – Yes

Recreational – No

Bottom Towed Fishing Gear (Prohibited Areas) Byelaw

Prohibition of bottom towed fishing gear

Area – Seafish Kingfisher fishing restrictions map areas: 2067, 2058, 2063, 2066, 2064, 2057

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

River Medway Nursery Area (Prohibition of Fishing) Byelaw

Prohibition on use of fishing gear and removal of seafish

Area – Seafish Kingfisher fishing restrictions map areas: 2065

Commercial – Yes

Recreational – Yes

Exceptions apply

Essex Estuaries Bottom Trawling (Prohibited Areas) Byelaw

Prohibition on use of fishing gear and removal of seafish

Area – Seafish Kingfisher fishing restrictions map areas: 2061, 2060, 2059, 2062

Commercial – Yes

Recreational – Yes

Placing and Using of Fixed Engines Byelaw

Prohibition on fixed nets

Area – Area 1.5nm from chimney of Richborough Power Station

Seasonality – April to September

Commercial – Yes

Recreational – Yes

Prohibition on fixed nets

Area – Upper Thames Estuary

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

Requirement for fixed nets to be cleared

Area – Seafish Kingfisher fishing restrictions map area: 2054

Commercial – Yes

Recreational – Yes

Gear marking requirements

Area – Seafish Kingfisher fishing restrictions map area: 2055

Commercial – Yes

Recreational – Yes

Net length maximum of 1,000m

Area – Seafish Kingfisher fishing restrictions map area: 2056

Commercial – Yes

Recreational – Yes

Small Mesh Trawl Nets Byelaw

Measure to provide capacity to restrict trawl mesh sizes below 75mm

Area – Seafish Kingfisher fishing restrictions map area: 2077

Commercial – Yes

Recreational – Yes

Herring Fishing Byelaw

Prohibition on trawling, dredging and anchored nets

Area – Eagle and Studhill Banks (Sandbanks)

Annex 11 Byelaws relating to the management of bass

Seasonality – February to June

Commercial – Yes

Recreational – Yes

Prohibition on drift nets over 250m length

Area – Eagle and Studhill Banks (Sandbanks)

Seasonality – March to July

Commercial – Yes

Recreational – Yes

Byelaw Relating to Bass Nursery Area at Bradwell

Prohibits removal of sea fisheries resources

Area – Bradwell foreshore

Seasonality – May to September

Commercial – Yes

Recreational – Yes

Fixed Engines (Nets) Byelaw

Net headline clearance requirements

Gear types – Fixed gillnets and unattended drift nets

Area – Seafish Kingfisher fishing restrictions map areas: 2053

Seasonality – May to September

Commercial – Yes

Recreational – Yes

Fishing Instruments Byelaw

Technical gear and target species measures

Gear types – Trawls, Pair trawls, drift nets, trammel or fixed gill nets, hooks, lines, longlines, beach seines, fyke nets, pots and traps

Area – Seafish Kingfisher fishing restrictions map areas: 2053

Commercial – Yes

Recreational – Yes

Trawling Exclusion Byelaw

Prohibition on trawling

Area – Seafish Kingfisher fishing restrictions map areas: 2054

Seasonality – May to October

Commercial – Yes

Recreational – Yes

Gill or Drift Nets Byelaw

Net attendance requirements

Area – K&EIFCA Area D

Commercial – Yes

Recreational – Yes

Drag or Seine Nets Byelaw

Net length and headline clearance requirements

Area – K&EIFCA Area D

Commercial – Yes

Recreational – Yes

Fixed and Trawl Nets Byelaw

Spatial prohibitions

Area – K&EIFCA Area D

Commercial – Yes

Recreational – Yes

Fishing in Creeks Byelaw

Prohibition on fishing (other than rod and line)

Area – K&EIFCA Area D

Commercial – Yes

Recreational – Yes

Prohibition on nets over mouths of creeks

Area – K&EIFCA Area D

Commercial – Yes

Recreational – Yes

Sussex IFCA

https://www.sussex-ifca.gov.uk/regulations

Fishing Instruments Byelaw

Permitted pair trawling area

Area – Seafish Kingfisher fishing restrictions map area: 1685

Seasonality – April to June

Commercial – Yes

Recreational – Yes

Fixed Engines Byelaw

Fixed Nets headline clearance requirements

Area – SxIFCA

Seasonality – May to September

Commercial – Yes

Recreational – Yes

Prohibition on fixed nets

Area – Seafish Kingfisher fishing restrictions map areas: 1681, 1682, 1679, 1677, 1678, 1676

Seasonality – May to September

Commercial – Yes

Recreational – Yes

Prohibition on fyke nets

Area – Seafish Kingfisher fishing restrictions map area: 1681

Annex 11 Byelaws relating to the management of bass

Seasonality – May to September

Commercial – Yes

Recreational – Yes

Marine Protected Area Byelaw

Kingmere MCZ

Prohibition on towed gear, seine and surrounding nets

Area – Seafish Kingfisher fishing restrictions map areas: 1668, 1669, 1670, 1671

Commercial – Yes

Recreational – Yes

Restrictions on towed gear, static gear, rod/line and dive gathering

Area – Seafish Kingfisher fishing restrictions map area: 1668

Seasonality – April to June

Commercial – Yes

Recreational – Yes

Prohibition on towed and static gear

Area – Seafish Kingfisher fishing restrictions map area: 1669, 1670, 1671

Seasonality – April to June

Commercial – Yes

Recreational – Yes

Beachy Head West MCZ

Prohibition on towed gear

Area – Seafish Kingfisher fishing restrictions map area: 1673

Commercial – Yes

Annex 11 Byelaws relating to the management of bass

Recreational – Yes

Restrictions on towed gear

Area – Seafish Kingfisher fishing restrictions map area: 1675

Commercial – Yes

Recreational – Yes

Prohibition on netting

Area – Seafish Kingfisher fishing restrictions map area: 1673

Commercial – Yes

Recreational – Yes

Prohibition on lining gear

Area – Seafish Kingfisher fishing restrictions map area: 1673

Commercial – Yes

Recreational – Yes

Pagham Harbour MCZ

Restrictions on towed gear

Area – Seafish Kingfisher fishing restrictions map area: 1666

Commercial – Yes

Recreational – Yes

Prohibition on netting, potting, lining and angling gear

Area – Seafish Kingfisher fishing restrictions map area: 1666

Seasonality – April to August

Commercial –Yes

Recreational – Yes

Utopia MCZ

Prohibition on towed gear

Area – Seafish Kingfisher fishing restrictions map area: 1667

Commercial – Yes

Recreational – Yes

Nearshore Trawling Byelaw

Prohibition on towed gear

Area – Seafish Kingfisher fishing restrictions map area: 1686

Commercial – Yes

Recreational – Yes

Vessel Length Byelaw

Prohibition on using fishing vessels over 14m OAL

Area – SxIFCA District

Commercial – Yes

Recreational – Yes

Exceptions apply

Southern IFCA

All Regulations : Southern IFCA (southern-ifca.gov.uk)

Bottom Towed Fishing Gear 2016 Byelaw

Prohibition on bottom towed gear

Area – Seafish Kingfisher fishing restrictions map areas: 1383 to 1422

Commercial – Yes

Recreational – Yes

Electric Current Byelaw

Prohibition on taking through discharge of electric current

Area – SoIFCA District

Commercial – Yes

Recreational – Yes

Fishing Under Mechanical Power Byelaw

Prohibition on mechanically powered trawling

Area – Seafish Kingfisher fishing restrictions map areas: 1475

Seasonality – May to August

Commercial – Yes

Recreational – Yes

Fixed Engines Byelaw

Prohibition on fixed engines

Area – Seafish Kingfisher fishing restrictions map areas: 1477 to 1479, 1483 to 1486

Seasonality – April to September

Commercial – Yes

Recreational – Yes

Foul Hooking Byelaw

Prohibition on hooking mullet and bass

Area – SoIFCA District

Commercial – Yes

Recreational – Yes

Minimum Conservation Reference Size Byelaw

Species MCRS – Bass (*Dicentrarchus labrax*) – 42cm

Area – SoIFCA District

Commercial – Yes

Recreational – Yes

Regulation of the use of Stake or Stop Nets in Langstone Harbour Byelaw

Prohibits use of certain net types

Area – Seafish Kingfisher fishing restrictions map areas: 1476

Commercial – Yes

Recreational – Yes

Annex 11 Byelaws relating to the management of bass

Exceptions apply

Sea Fisheries Fixed Engine Prohibition Byelaw

Prohibits use of fixed nets

Area – Water inland of landward boundary of SoIFCA District

Commercial – Yes

Recreational – Yes

Exceptions apply

Vessels Used in Fishing Byelaw

Prohibition on using fishing vessels over 12m OAL

Area – SoIFCA District

Commercial – Yes

Recreational – Yes

Exceptions apply

Vessels Used in Fishing for Sale Byelaw

Requirement for registration with the IFCA if fishing commercially

Area – SoIFCA District

Commercial – Yes

Recreational – No

Exceptions apply

Net Fishing Around Piers Code of Practice

Voluntary exclusion of nets

Area – Listed piers in SoIFCA District

Commercial – Yes

Recreational – Yes

Exceptions apply

Devon and Severn IFCA

https://www.devonandsevernifca.gov.uk/Enforcement-Legislation/Current-Permit-Byelaws-Permit-Conditions

Potting Permit Byelaw

Permit requirements

Area – D&SIFCA District

Commercial – Yes

Recreational – Yes

Species MCRS – Bass (*Dicentrarchus labrax*) – 42cm

Area – D&SIFCA District

Commercial – Yes

Recreational – Yes

Gear marking requirements

Area – D&SIFCA District

Commercial – Yes

Recreational – Yes

Prohibition on use off undersized shellfish as bait

Area – D&SIFCA District

Commercial – Yes

Recreational – Yes

Prohibition on taking sea fisheries resources

Area – Seafish Kingfisher fishing restrictions map areas: 1335

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

Gear construction requirements

Area – Waters inland of estuary closing lines in D&SIFCA District

Commercial – Yes

Recreational – Yes

Netting Permit Byelaw

Permit requirements

Area – D&SIFCA District

Commercial – Yes

Recreational – Yes

Species MCRS – Bass (*Dicentrarchus labrax*) – 42cm

Area – D&SIFCA District

Commercial – Yes

Recreational – Yes

Gear marking requirements

Area – D&SIFCA District

Commercial – Yes

Recreational – Yes

Prohibition on net mesh size range 71-89mm

Area –D&SIFCA District

Commercial – Yes

Recreational – Yes

Drift net attendance requirement

Area –D&SIFCA District

Commercial – Yes

Recreational – Yes

Seine net operation requirements

Area –D&SIFCA District

Commercial – Yes

Recreational – Yes

Prohibition on nets

Area – Seafish Kingfisher fishing restrictions map areas: 1297, 1298, 1299, 1300, 1302, 1305, 1306, 1308, 1309, 1310, 1311, 1312, 1313, 1351

Commercial – Yes

Recreational – Yes

Exceptions apply

Prohibition on seine and drift nets

Area – Seafish Kingfisher fishing restrictions map areas: 1342, 1341, 1340, 1346, 1345, 1344, 1343, 1348, 1347

Commercial – Yes

Recreational – Yes

Exceptions apply

Headline clearance requirements

Area – Seafish Kingfisher fishing restrictions map areas: 1342, 1341, 1340, 1346, 1345, 1344, 1343, 1348, 1347

Commercial – Yes

Recreational – Yes

Prohibition on nets

Area – Seafish Kingfisher fishing restrictions map area: 1314

Commercial – Yes

Recreational – Yes

Prohibition on nets

Area – Seafish Kingfisher fishing restrictions map area: 1315

Seasonality – September to April

Commercial – Yes

Recreational – Yes

Mobile Fishing Permit Byelaw

Permit requirements

Area – D&SIFCA District

Commercial – Yes

Recreational – No

Exceptions apply

Species MCRS – Bass (*Dicentrarchus labrax*) – 42cm

Area – D&SIFCA District

Commercial – Yes

Recreational – No

Vessel Monitoring System requirements

Area – D&SIFCA District

Commercial – Yes

Recreational – No

Exceptions apply

Prohibition on demersal mobile gear

Area – Seafish Kingfisher fishing restrictions map area: 1257, 1260, 1261, 1266, 1271, 1349, 1289, 1285, 1284, 1283, 1287, 1286, 1282, 1256, 1290, 1294

Commercial – Yes

Recreational – No

Exceptions apply

Inherited Environment Agency Byelaws

Sea Fishing in Areas Inland of Devon Sea Fisheries Committees District

Prohibits use of fixed nets

Area – Water inland of landward boundary of DSFC District

Commercial – Yes

Recreational – Yes

Sea Fishing in River Severn

Prohibits use of fixed nets

Area – River Severn

Commercial – Yes

Recreational – Yes

Trawling and Trammelling (Taw and Torridge)

Prohibits use of trawl and trammel nets

Area – Taw and Torridge

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

Mesh and Nets (Taw and Torridge), Reducing Mesh and Nets (Taw and Torridge)

Net construction requirements

Area – Taw and Torridge

Commercial – Yes

Recreational – Yes

Prevent Sea Fishing in the Tidal River Yeo (Barnstable) (River Yeo)

Prohibits removal of sea fish

Area – River Yeo

Commercial – Yes

Recreational – Yes

Inherited DSFC Byelaws

Prohibition of Spear Fishing in Lundy Marine Conservation Zone (MCZ)

Prohibition on spear fishing

Area – Lundy MCZ

Commercial – Yes

Recreational – Yes

Size of Vessels Byelaw

Prohibition on using fishing vessels over 15.24m OAL

Area – D&SIFCA District

Commercial – Yes

Recreational – Yes

Cornwall IFCA

Byelaws & Regulations : Cornwall Inshore Fisheries and Conservation Authority (CIFCA) (cornwall-ifca.gov.uk)

River and Estuarine Fish Byelaw

Prohibits gill, tangle, seine, ring and trawl nets

Area – Waters inland of estuary closing lines in CIFCA District

Commercial – Yes

Recreational – Yes

Fixed Engines Byelaw

Net headline clearance requirements

Area – Specified areas of CIFCA District

Commercial – Yes

Recreational – Yes

Mesh of Nets Byelaw

Sets minimum mesh size of 250mm

Area – Specified areas of CIFCA District

Commercial – Yes

Recreational – Yes

Size of Vessels Byelaw

Prohibition on using fishing vessels over 15.24m OAL

Area – CIFCA District

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

Isles of Scilly IFCA

Byelaws : Isles of Scilly IFCA

Fishing Gear Permit Byelaw

Prohibition on using fishing vessels over 10 tonnes or 11m OAL

Area – IOSIFCA

Commercial – Yes

Recreational – Yes

Exceptions apply

Prohibition on towed fishing gear

Area – Seafish Kingfisher fishing restrictions map area: 1015

Commercial – Yes

Recreational – Yes

Gear construction and operation restrictions

Area – IOSIFCA

Commercial – Yes

Recreational – No

North Western IFCA

Byelaws - IFCA North West (nw-ifca.gov.uk)

Heysham Bass Nursery Area Prohibition of Fishing Byelaw

Prohibition on removal of sea fish or possession of fishing gear

Area – Seafish Kingfisher fishing restrictions map area: 2080

Commercial – Yes

Recreational – Yes

Inherited North West Sea Fishery Committee Byelaws

Attachments to Nets Byelaw

Prohibition of attachments that diminish net size

Area – Seafish Kingfisher fishing restrictions map area: 2083

Commercial – Yes

Recreational – Yes

Prohibition of Seine Netting Byelaw

Prohibition of seine nets

Area – Seafish Kingfisher fishing restrictions map area: 2090

Commercial – Yes

Recreational – Yes

Mesh Sizes – Nets Other Than Trawls Byelaw

Sets minimum net mesh size

Area – Seafish Kingfisher fishing restrictions map area: 2085 (intertidal only)

Commercial – Yes

Recreational – Yes

Small Mesh Nets – Other Than Trawl Nets - Restrictions Byelaw

Sets maximum net mesh size

Area – Seafish Kingfisher fishing restrictions map area: 2086 (intertidal only)

Commercial – Yes

Recreational – Yes

Exceptions apply

Mechanically Propelled Vessels – Maximum Length Byelaw

Prohibition on using fishing vessels 15m OAL

Area – Seafish Kingfisher fishing restrictions map area: 2087

Commercial – Yes

Recreational – No

Exceptions apply

Set and Drift Nets Byelaw

Gear marking requirements

Area – Seafish Kingfisher fishing restrictions map area: 2088

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

Gear density requirements

Area – Seafish Kingfisher fishing restrictions map area: 2088

Commercial – Yes

Recreational – Yes

Marking of Fishing Gear and Keep Pots Byelaw

Gear marking requirements for static gear

Area – Seafish Kingfisher fishing restrictions map area: 2089

Commercial – Yes

Recreational – Yes

Gear density requirements

Area – Seafish Kingfisher fishing restrictions map area: 2089

Commercial – Yes

Recreational – Yes

Sets maximum net length of 275m

Area – Seafish Kingfisher fishing restrictions map area: 2089

Commercial – Yes

Recreational – Yes

Specified Fish Species Byelaw

Species MCRS – Bass (*Dicentrarchus labrax*) – 42cm

Area – Seafish Kingfisher fishing restrictions map area: 2089

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

Fixed Engines – Prohibitions and Authorisations Byelaw

Prohibition on fixed netting

Area – Duddon, Leven, Kent, Keer, Lune, Wyre and Ribble Estuaries

Seasonality – May to November

Commercial – Yes

Recreational – Yes

Exceptions apply

Mobile Nets – Prohibitions and Authorisations Byelaw

Prohibition on mobile netting (drift, draft, seine)

Area – Duddon, Leven, Kent, Keer, Lune, Wyre and Ribble Estuaries

Seasonality – May to November

Commercial – Yes

Recreational – Yes

Exceptions apply

Inherited Cumbria Sea Fisheries Committee Byelaws

Size Limits of Boats Allowed Inside the District Byelaw

Sets maximum vessel size

Area – Seafish Kingfisher fishing restrictions map areas: 2093, 2094

Commercial – Yes

Recreational – Yes

Exceptions apply

Marking and Siting of Fixed Nets, Traps, Pots and Lines Byelaw

Gear marking requirements

Area – Seafish Kingfisher fishing restrictions map areas: 2093, 2094

Commercial – Yes

Recreational – Yes

Gear density requirements

Area – Seafish Kingfisher fishing restrictions map areas: 2093, 2094

Commercial – Yes

Recreational – Yes

Fixed Engine Fishery Byelaw

Prohibition on fixed engines

Area – Upper Solway

Seasonality – February to September

Annex 11 Byelaws relating to the management of bass

Commercial – Yes

Recreational – Yes

Prohibition on seine or drift nets

Area – Upper Solway

Commercial – Yes

Recreational – Yes

Prohibition on fixed engines

Area – Rivers Ellen, Derwent,Ehen, Calder, Irt, Mite and Esk

Seasonality – April to November

Commercial – Yes

Recreational – Yes

Net headline clearance requirements

Area – Seafish Kingfisher fishing restrictions map area: 2099

Seasonality – June to November

Commercial – Yes

Recreational – Yes

Net clearing requirements

Area – Seafish Kingfisher fishing restrictions map area: 2099

Commercial – Yes

Recreational – Yes

Sets maximum net length of 250m

Area – Seafish Kingfisher fishing restrictions map area: 2099

Commercial – Yes

Annex 11 Byelaws relating to the management of bass

Recreational – Yes

Prohibition on nets in channels less than 300m wide at low water

Area – Seafish Kingfisher fishing restrictions map area: 2099

Commercial – Yes

Recreational – Yes

Multi-Rigged Trawling Gear Byelaw

Prohibition on multi rigged otter trawls

Area – Seafish Kingfisher fishing restrictions map area: 2096

Commercial – Yes

Recreational – Yes

Vessels with a Registered Engine Power >221KW Byelaw

Prohibits vessels exceeding 221kw power

Area – Seafish Kingfisher fishing restrictions map area: 2101

Commercial – Yes

Recreational – Yes

Inherited National Rivers Authority Byelaws

Use of Instruments Byelaw

Gear type, temporal and spatial restrictions

Area – Dee Estuary

Commercial – Yes

Recreational – Yes

Use if Nets - Beam and Otter Trawl Byelaw

Gear use restrictions

Area – Dee Estuary

Commercial – Yes

Recreational – Yes

Inherited Environment Agency Byelaws

Sea Fisheries Byelaw

Prohibition on fishing other than with rod and line

Area – Rivers Sark, Esk, Eden, Wampool, Waver, Ellen, Derwent, Ehen, Calder, Esk, Irt, Mite, Duddon, Leven, Winster, Kent, Bela, Keer, Lune, Cocker, Wyre, Douglas, Mersey and Weaver

Commercial – Yes

Recreational – Yes

South Wales inshore fishery legislation

For details on the byelaws listed below, refer to:

South Wales inshore fishery legislation | GOV.WALES

Byelaw 8. Bass - minimum size

Byelaw 25. Prohibited area for towed fishing gear Milford Haven

Byelaw 26. Prohibited area for trawl and seine nets Milford Haven

Byelaw 27. Prohibited area for use of dredges and beam trawls - Skomer

Byelaw 29. Bass nursery area-restrictions on fishing

Byelaw 31. Drift net prohibitions

Byelaw 32. Mesh sizes-nets other than trawl and purse seine nets

Annex 11 Byelaws relating to the management of bass

Byelaw 33. Set, stake and stop nets

Byelaw 34. Set and drift nets

Byelaw 35. Reducing mesh of nets

Byelaw 37. Beach drag and beach seine nets

Byelaw 38. Maximum vessel size

Byelaw 39. Beam trawl restriction

Byelaw 42. Set or night lines

Byelaw 43. Foul hooking of sea fish

Byelaw 44. Marking of fishing gear and keep pots

North Western & North Wales Sea Fisheries Committee

For details on the byelaws listed below, refer to:

Inshore fishery legislation: definitions of North and North West inshore district byelaws | GOV.WALES

Byelaw 4 - - 8 mesh size - trawl nets

Byelaw 7 mesh sizes - nets other than trawl nets

Byelaw 9 mechanically propelled vessels – maximum length

Byelaw 10 set and drift nets

Byelaw 11 marking of fishing gear and keep pots

Byelaw 18 foul hooking of sea fish

Byelaw 19 specified fish sizes

Byelaw 21 prohibition of bottom towed fishing gear

Byelaw 24 fixed engines - prohibitions (Wales)

Byelaw 25 drift nets – prohibitions (Wales)