This document shows the presentation of Devon and Severn IFCA's bass survivability research, as presented to the main Authority meeting on 16th March 2023. Any slides with animations have been edited to show the unanimated content on individual slides, so that content is not obscured. This version has been annotated with the presentation script to provide additional context for images and figures.

Devon and Severn Inshore Fisheries and Conservation Authority

Understanding Bass Survivability in Inshore Netting

Dr James Stewart
Senior Environment Officer

Background: European seabass (*Dicentrarchus labrax*)

- High value species
- Declining SSB & restrictive management
- High discards & emerging understanding of discard mortality

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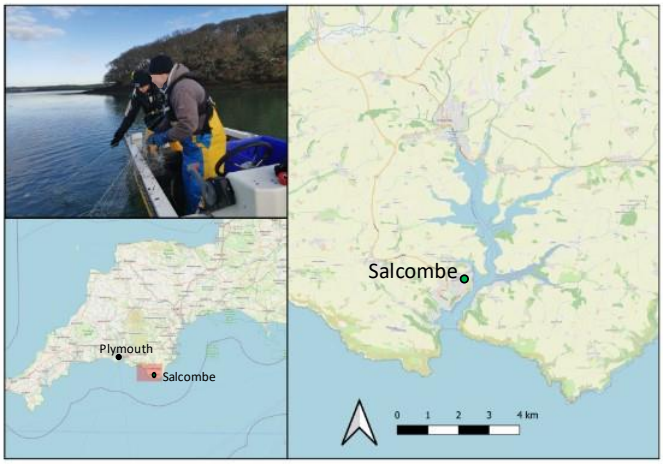
The European Seabass is a high value species for both commercial and recreational fishers. However, the spawning stock biomass has declined in recent years and there are also high levels of discards in fisheries where management measures restrict catches and landings, yet the survival of discarded seabass isn't always well-understood. In particular, while recent research on seabass discard survival has focused on survival in at-sea fisheries that use a range of gears with relatively long soak times, discard survival from smaller-scale, inshore activities with short soak times remains unmeasured.

Site-specific research

- Research to understand inshore netting interaction with bass
- Worked in Salcombe with local fisherman setting 4” mesh gill nets under exemptions



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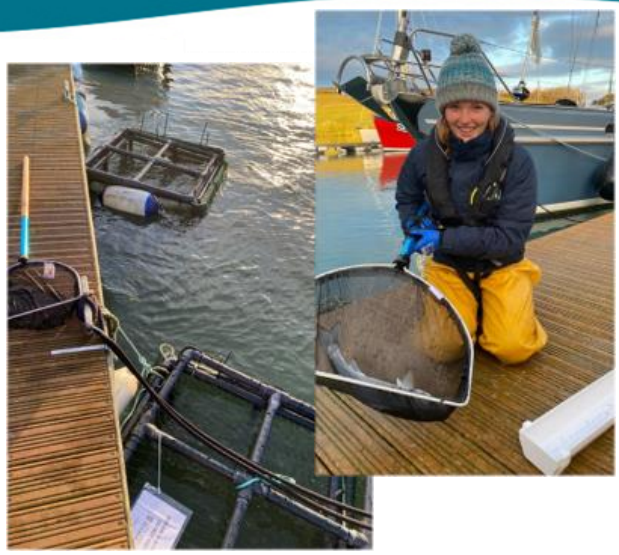
To address this lack of evidence, D&S IFCA has been undertaking site-specific research to understand the survivability of bass in small-scale inshore netting activities that would otherwise target species such as mullet and gilthead bream. Understanding the survival of discarded bass in small-scale netting activities is important for understanding the effectiveness of broader UK and European-level management, while greater evidence gathering on fish interactions with fishing gear can also help inform future decision making on the management of netting activities within D&S IFCA’s District.

So, in early January 2022 and in January 2023, D&S IFCA Officers were in Salcombe Estuary to survey and monitor netting activities with a local fisher, operating under dispensation from the Marine Management Organisation (MMO) and exemption from D&S IFCA Byelaws.

Netting & bass assessments

- 100-200m gillnets (4” mesh, 2m deep)
- Up to 1 hour soak time
- Vitality assessment (Cefas 2022) & retention in seawater
- Follow up assessment after recovery in sea cages



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On each fishing trip, the fisher was asked to conduct normal fishing activities. Short lengths of 2m deep monofilament gillnet were deployed for soak times of up to 1 hour. Discarding of fish normally takes place as soon as they are found during sorting, so catch was removed from the net during the haul and the bass were either transferred directly to the onboard observer for assessment or to a seawater holding tank until the first assessment could be conducted. Therefore, the first assessment for each fish took place *either* immediately on removal from the net *or* shortly after a recovery period in a tank of seawater on board the netting vessel. After the first assessment the fish were transferred to seawater cages (or a live well tank on a moored vessel). The fish remained in there until their second assessment, usually around one hour after capture. The second (medium term) vitality assessment was an identical assessment process to the first assessment, and was used to detect improvement or deterioration in condition.

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Reflex Name	Description
Body flex	Vigorous flexing within 5 s of being held
Head complex	Regular pattern of ventilation with jaw and operculum, within 5 s
Righting	Active return to normal orientation when turned upside down, within 5 s
Evade	Active capture avoidance
Tail grab	Burst movement away from tail grab, within 5 s
Vestibular-ocular response	Eyes roll to track researcher when body rotated around long axis

The health or vitality of fish was assessed using two methods developed by Cefas on bass in the wild and in laboratory tanks. There was a coarse assessment of the vitality of each fish based on four categories (next slide), and an assessment of six reflexes that Cefas found to be suitable indicators of sea bass vitality: body flex, evade, head complex, righting, tail grab, and vestibular-ocular response (eye-roll). These were each either scored as unimpaired when strong or easily observed, or impaired when not present or if in doubt of presence. Injury was scored as present or absent for each of 12 injury types.

Generally the net was set again before transporting fish back to the seawater cages on the dock. In 2023 a livewell tank was also used for the recovery phase. Fish could then recover before a second (medium term) vitality assessment – this was an identical assessment process to detect improvement or deterioration in condition. In each case the time between capture and each assessment was recorded (0 mins for those fish that were assessed at capture)

Netting & bass assessments

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Vitality	Description
Excellent	Vigorous body movement; no or minor$_a$ external injuries only
Good	Weak body movement; responds to touching; minor$_a$ external injuries
Poor	No body movement but fish can move operculum; minor or major external injuries
Dead	No body or operculum movements (no response to touching)

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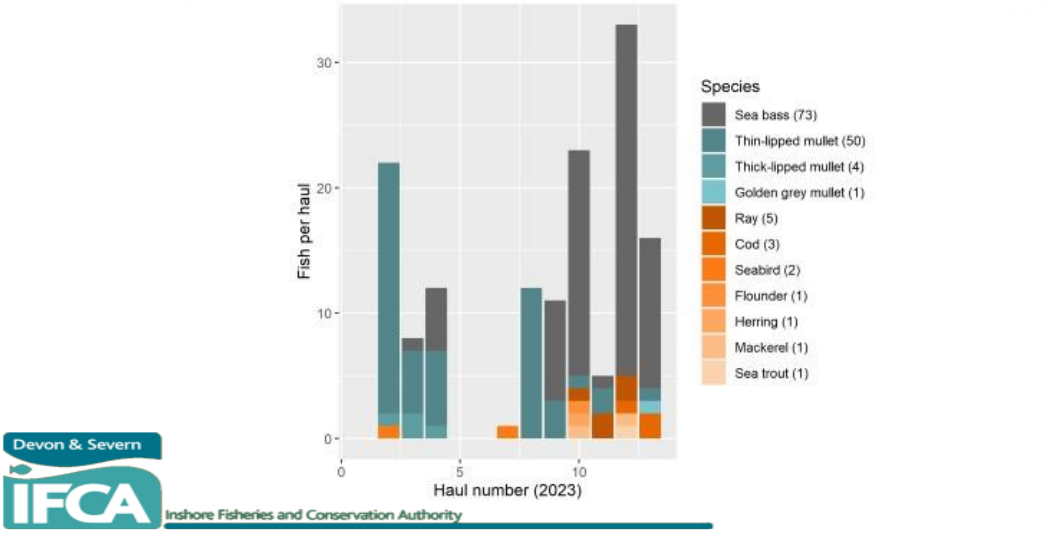
Generally the net was set again before transporting fish back to the seawater cages on the pontoon. In 2023 a livewell tank was also used for the recovery phase. Fish could then recover before a second (medium term) vitality assessment – this was an identical assessment process to detect improvement or deterioration in condition. In each case the time between capture and each assessment was recorded (0 mins for those fish that were assessed at capture)

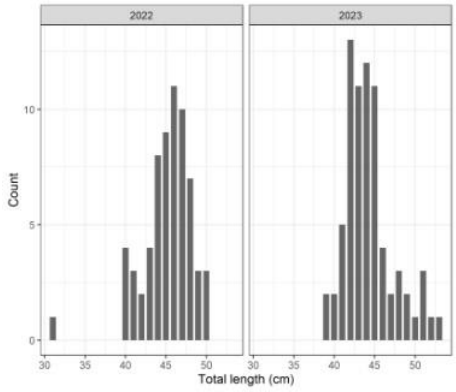
Catch composition



In the 32 hauls over 2022 and 2023, there was a total bycatch of 138 European sea bass (*D. labrax*) among a catch of mullet and a small number of other bycatch species. This figure shows the count of each species caught for 2023; species other than bass were not fully counted in 2022. However, hauls in 2022 included a catch of a similar number of mullet, one seabird, two thornback rays and a shad. Of the 141 fish caught in 2023, 73 (52%) were sea bass, while only 55 (39%) were mullet species.

As demonstrated by this figure, the catch composition using gillnets in the study area is unpredictable: in 2023 mullet (a likely target catch using this gear type) comprised anywhere between 0 – 100% of the catch (mean 47.2% of the catch in hauls that caught fish), while sea bass (which cannot be landed for most of the year) comprised anywhere between 0 – 85% (mean 42.8%). Two seabirds were caught in 2023 and one in 2022; this is likely a result of fishing during the day. Night-time netting, which is likely to be more common in this kind of fishery, would be less likely to catch seabirds due to their inactivity at night.

Short-term bass vitality & survival



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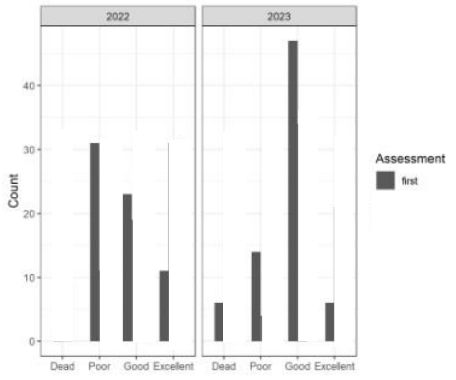
This figure shows the size distribution of the fish that were caught – 65 fish in total in 2022, mostly over 40cm in total length, 73 fish in 2023, mostly over 40cm. 12% total undersize (< 42 cm)

Short-term bass vitality & survival



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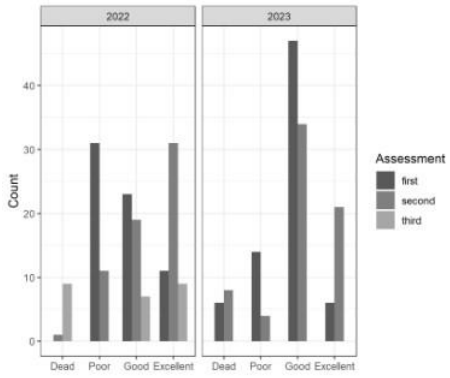
This figure shows in dark grey the first coarse vitality assessment results for each fish; you can see that the at-vessel vitality assessments showed that most fish were in poor or good condition with relatively few dead but also few unscathed. More had died by the first assessment in 2023 than in 2022 – likely because the first assessment was delayed in 2023 compared to 2022, meaning that some fish in poor condition upon capture deteriorated between capture and the first assessment. By contrast in 2022 the assessment took place immediately upon capture and the post-capture deterioration wasn't detected until the second assessment.

Short-term bass vitality & survival



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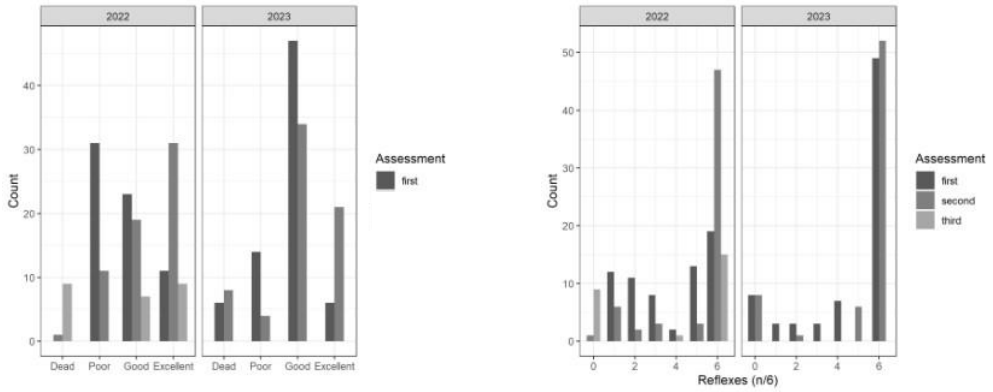
By the second assessment in 2022, most fish had improved somewhat, though one had died. By the third assessment in 2022 a further 9 fish had died. 10 out of 65 fish died in 2022, 14 out of 73 fish died in 2023. There was no apparent difference in mortality with fish length but there is weak evidence to suggest that they are more likely to subsequently die if net hauls take longer periods of time (ie the more fish are caught, the more likely the discards are to die). More had died by the first assessment in 2023 than in 2022 – likely because the first assessment was delayed in 2023 compared to 2022, meaning that some fish in poor condition upon capture deteriorated between capture and the first assessment. By contrast in 2022 the assessment took place immediately upon capture and the post-capture deterioration wasn't detected until the second assessment.

Short-term bass vitality & survival



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The right-hand figure shows how many reflexes out of 6 were being displayed by each fish during the assessments – a range of reflexes were shown but most fish improved by the second assessment to have all reflexes unimpaired. Those showing no reflexes were dead. Those showing only one or two at the first assessment appeared more likely to go on to later die.

Short-term bass vitality & survival

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Selection of injury types – net marks (first image), bruising and gill flaring (second image) and gill flaring with mild barotrauma (third image). The presentation of gill flaring appeared to predict mortality, and this mostly occurred during the net haul or during removal from the net. The two fish in the right hand image are in a tank with two others (just visible in top right corner) – therefore this is an impact of the netting, not of being in the container of water.

Acoustic Telemetry with FISH INTEL

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UNIVERSITY OF PLYMOUTH

European Commission

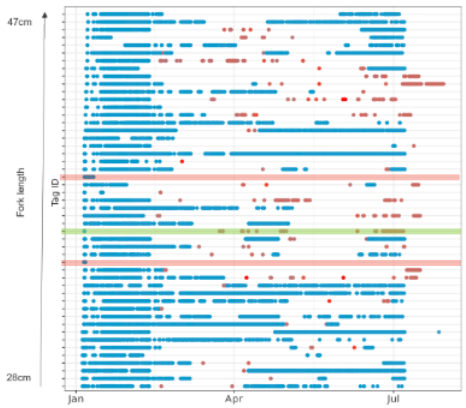
Interreg France (Channel Manche) England

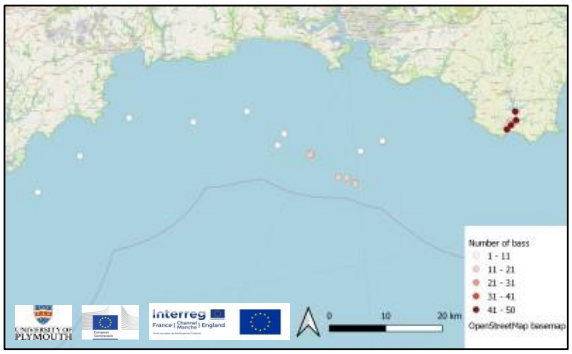
In each year an operating theatre was set up on board a moored fishing vessel, where a total of 86 bass in good or excellent condition were then implanted with acoustic tags (under anaesthesia) by the FISH INTEL team from University of Plymouth. All tagging work was conducted under Home Office licence by the FISH INTEL team in accordance with the Animals (Scientific Procedures) Act 1986.

Acoustic tags within the fish emit ‘pings’ that are detected by ‘receivers’ placed in the water at strategic locations (map on next slide); this allows us to understand the geographic movement patterns of each individual fish. This tagging work was undertaken by FISH INTEL to feed into their long-term research on bass movement and habitat use, but it also allows us to make a long-term assessment of bass survival, and a comparison of the behaviour of these bass with a previously-tagged cohort which were caught by rod and line in 2018.

The red points on this map show the placement of acoustic receivers in Salcombe.

Acoustic telemetry & longer-term survivability





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The left hand plot is an abacus plot, with a row showing the detections for an individual fish. Blue dots are detections in Salcombe, red are detections on receivers outside of Salcombe. The two fish highlighted in red have no detections after a couple of days. This could be indicative of mortality or that the fish have travelled elsewhere. For example, by comparison the fish highlighted in green has a long period of no detections in Salcombe but was subsequently detected elsewhere. Implication of this plot and the tracking data is that fish that have good vitality assessments immediately after capture appear to have very good long-term survivability rates. The right-hand map figure shows detections in Salcombe and at acoustic receivers along the south coast, coloured by number of bass observed at each receiver. Note that both figures refer only to bass caught in 2022 (data for 2023 not yet available), with tracking data only shown up to July 2022.

Implication overall is that potentially up to 83% of the fish caught in these nets with short soak times survived for a relatively long period after being returned to the sea, though it should be noted that discard mortality may well be higher when there are no observers on board the fishing vessel (fisher was occasionally/frequently cutting fish out of the net, and this does not appear likely for all fishers or in all situations, where fish are more likely to be squeezed from the net; true mortality could therefore be higher).

Summary of results

- Unpredictable catch composition, ~ 50% bass catch
- 12 % of bass were undersize– generally more selective than rod and line, less selective than larger mesh e.g. 105 mm
- ~17% mortality– higher than targeted rod and line, lower than nets with longer soak times
- Those that survive past the first few hours post-capture appear to have good long-term survival rates
- Unknown observer impact and variation in fisher behaviour

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Next steps

- Analysis of tagging data – survival curves, comparisons between fish and between cohorts

- Future work
  - Continued monitoring via acoustic receiver arrays

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Finally, this slide summarises some of the next steps for future work with this study – we're only just getting going with the analysis, so there's lots more that can be done with the tagging data

The tagging data have already suggested relatively high survivability for those fish that have good vitality assessments shortly after capture, but there are still comparisons to be carried out in terms of comparing behaviour between fish and between the fish in this study caught by nets and those caught by rod and line in a previous cohort.

These fish and many others will continue to be monitored via the acoustic receiver arrays in Salcombe, along the south coast and even more broadly