Shark By-Watch UK 2

Research priorities: innovative solutions for reducing by-catch and dead-discards of threatened* sharks, skates & rays

**The International Union for Conservation of Nature (IUCN) categories of Vulnerable, Endangered or Critically Endangered species.*

How to refer to this document:

All the work in this document is attributable to the participants of the Shark By-Watch UK 2 project. We encourage those reading this work to share the messages and recommendations within, and you are free to do so.

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Summary

- **Shark By-Watch UK is a collaborative project, working on elasmobranchs – sharks, skates and rays – in UK fisheries. The project covers both targeted elasmobranch fisheries, and unintended interactions of these species with fishing gear; by-catch.**

- **The project involves a range of stakeholders – fishermen, scientists, policy, non-government organisations (NGOs), retailers and more – each with a different interest in, or knowledge of, elasmobranchs and fisheries. Input from all of these groups is a vital and valued part of the Shark By-Watch UK research process.**

- **Following a participatory workshop in which all stakeholders gathered to discuss the issue of 'by-catch and dead discards of threatened sharks, skates and rays' the project has produced a range of recommendations for future research priorities in this area. These priorities centre around research methodology, gear innovation and new management strategies.**

- **These recommendations have been put forward to proactively tackle the environmental and economic challenges posed by elasmobranch by-catch in UK fisheries and to contribute to the successful implementation of the landing obligation, part of the reformed Common Fisheries Policy (CFP).**

One of the vessels involved in participatory data collection as part of the Shark By-Watch UK project.

Introduction

What is Shark By-Watch UK 2?

Shark By-Watch UK is a fisher-led initiative that aims to improve the long-term management of a range of elasmobranch populations in UK waters. It will improve scientific knowledge and understanding of sharks, skates and rays, and their discard survival, to underpin evidence-based policy decisions for their sustainable management. Shark By-Watch UK 2 is the current, second phase of the project, which builds upon the success of Shark By-Watch UK's original research, in which fishers gathered biological data on over 8,000 elasmobranchs.

Who's involved & what species are covered by the research?

Shark By-Watch UK 2 is a participatory research initiative, meaning that research design, implementation and analysis is a collaborative effort between scientists and other stakeholders – in this case, fishers. By training fishers in data collection and using their knowledge, gathered over generations, Shark By-Watch UK 2 aims to improve understanding of elasmobranch distribution, life history, by-catch and discard survival in UK waters.

Alongside fishers, the project involves a range of stakeholders from fisheries associations to

scientists, NGO representatives, government bodies and policy makers. **By encompassing a broad spectrum of stakeholders, the project ensures that outputs have the maximum impact, generating high levels of 'buy-in' from all involved.**

The UK's waters host a wide range of elasmobranch species. The Shark By-Watch UK project has been focusing research efforts on a selection of species in inshore waters and further afield. This includes, but is not limited to: thornback ray, spurdog, common skate, porbeagle and basking shark. (For further information on the species covered by the project, see page 10).

What are the project's objectives & how will these affect different stakeholders?

To minimise the accidental by-catch of certain elasmobranchs, and to improve scientific evidence for regulatory bodies and policy makers, Shark By-Watch UK works collaboratively with different stakeholder groups. This collaborative research aims to build an evidence base of by-catch and discard survival of different elasmobranch species. **The project's work also includes the research and development of innovative solutions to reduce elasmobranch by-catch and the scoping of alternative management techniques that may support sustainable elasmobranch fisheries in UK waters long into the future.**

A fisherman measures a thornback ray as part of Shark By-Watch UK data collection. Fishers are trained in data-gathering techniques by the project's scientists.

Elasmobranch by-catch – such as the significant spurdog by-catch seen here – can have a serious economic impact on fisheries due to the time taken to clear nets of unwanted catch.

The Key Issues

Lack of data

In contrast to many other commercially exploited fish species like cod, haddock and plaice, relatively little is known about the status of elasmobranch populations within UK waters. As a result, for many elasmobranch stocks, it is difficult to determine the appropriate level of sustainable exploitation. This lack of data can trigger the use of precautionary management measures. These precautionary measures can be viewed by some sectors of the fishing industry as overly punitive and ineffective. **Addressing knowledge gaps for these species through appropriate data collection can guide better-informed management decisions, with greater buy-in from industry.**

Economic impact

Fisheries with a high proportion of elasmobranch by-catch are likely to experience an economic impact, due to the associated gear damage and extended periods of down-time from clearing nets of unwanted by-catch.

Challenges posed by the reformed Common Fisheries Policy (CFP)

The reformed CFP contains a range of new measures, including the implementation of a landing obligation (discard ban). In recognition of the significant change that the landing obligation represents, it is being introduced gradually from 2015 to 2019. By 2019, fishers will have to land all their catch of Total Allowance Catch (TAC) species; prohibited species are not subject to the landing obligation and must continue to be discarded.

In accordance with the timeline for the phasing in of the landing obligation, the inclusion of elasmobranch by-catch within targeted fisheries is not likely to be subject to the regulation until 2019. However, it is possible that targeted elasmobranch fisheries - such as skates and rays - may be included earlier.

Although the discarding of unwanted fish is largely seen as a wasteful and destructive process, a large number of elasmobranchs are thought to be returned back to sea alive (although the long-term survival of these fish has yet to be fully researched). This means that retaining by-caught elasmobranchs on board as part of the landing obligation may result in further impacts on shark, skate and ray populations in comparison to the current practice of discarding.

Additionally, for those elasmobranchs with a minimal or zero TAC there is the potential for them to become 'choke' species in mixed fisheries. The presence of 'choke' species in the catch could force fishermen to stop fishing with certain gears, at certain times and in certain areas, and may force them to stop fishing altogether.

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A fisher hauls in his catch. Elasmobranch fisheries are important to UK fishers and coastal communities.

The challenge is therefore to identify pragmatic solutions to reduce unwanted elasmobranch by-catch in the first instance, and secondly not to increase fishing-induced mortality for elasmobranchs that are by-caught.

Stakeholders

Who is involved in Shark By-Watch UK 2 & why?

Individual fishermen: Sharing knowledge and participating at all levels of this project, fishermen are involved in survey and co-operative tagging programmes. Shark By-Watch UK scientists work closely with the fishers, training them in research methods and using their fishing gear and vessels as scientific platforms to collect much-needed data. Through their work with the project, fishermen become the custodians of their own data and are able to input suggestions as to how the sustainability of their fisheries might be practically improved.

Centre for Environment, Fisheries & Aquaculture Science (Cefas, project leader): Cefas' multi-disciplinary team of highly experienced fisheries scientists and biologists work closely with fishermen, collecting field data and overseeing complex issues, in order to make robust and long-term recommendations.

Department for Environment, Food & Rural Affairs (Defra) – UK Government: Defra have previously commissioned fisheries research and advisory programmes to enable the UK Government to meet its commitments to the Shark, Skate and Ray Conservation Plan published by Defra in January 2011 and, more recently, the reformed CFP.

Participatory workshop

On 1st September 2015, in partnership with the Zoological Society of London (ZSL), Shark By-Watch UK 2 held a workshop at ZSL on *'Innovative solutions to reduce by-catch and dead discards of threatened sharks, skates and rays'* to collate stakeholder knowledge on the species listed overleaf.

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Attendees at the participatory workshop break out into groups for focused discussion on potential solutions to reduce by-catch.

Inshore Fisheries & Conservation Authority (IFCA) – Devon & Severn, Isles of Scilly, Eastern, and Kent & Essex regions: These regional IFCAs aim to ensure healthy seas, sustainable fisheries and a viable fishing industry by securing the right balance between social, environmental and economic benefits locally. The IFCAs have participated in regional action-based workshops to share and develop knowledge, and undertake habitat-mapping studies to inform development of regional or local management measures.

Isle of Man Fisheries Directorate: Government department responsible for the economic and sustainable use of the Isle of Man's marine resources. Funding targeted mainly through the Manx Wildlife Trust and Manx Basking Shark Watch.

Scottish Natural Heritage (SNH): Custodian of Scotland's nature and landscapes, SNH's role includes generating a better understanding of marine fisheries, and increasing sustainability. SNH have collaborated in applying innovative methods to reduce by-catch and dead discarding of threatened elasmobranchs including basking sharks.

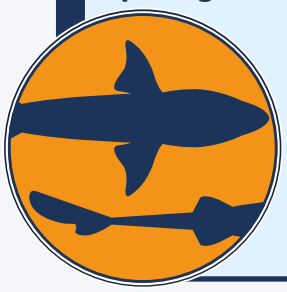
WM Morrison Supermarkets plc (Morrisons): The fourth largest supermarket chain in the UK, with an estimated 150 metric tons of ray wings sold annually across the country. Through workshops, presentations to fishermen and the use of its supply chain, Morrisons is demonstrating its role in the delivery of more sustainable elasmobranch fisheries.

Organisations involved in the workshop:

- Aberdeen University
- Department for Environment, Food and Rural Affairs
- Exeter University
- Falfish
- Manx Basking Shark Watch
- Marine Conservation Society
- Muséum National d'Histoire Naturelle (France)
- National Federation of Fishermen's Organisations
- National Oceanography Centre Southampton
- New England Aquarium (USA)
- North Devon Fishermen's Association
- Scottish Association for Marine Science
- Seafish
- Sea Mammal Research Unit
- Zoological Society of London
- The Wet Lab (USA).

Focus species

The focal species included common skate (*Dipturus batis* 'complex'), porbeagle (*Lamna nasus*), basking shark (*Cetorhinus maximus*), and spurdog (*Squalus acanthias*).

Species	Scientific name	IUCN status	UK management strategy	Discard/fisheries issue
Common skate 	*Dipturus batis* 'complex'	Critically Endangered	Prohibited to fish for, retain, tranship, land in EU waters.	Vulnerable to by-catch in demersal fisheries operating in the Celtic Sea.
Basking Shark 	*Cetorhinus maximus*	Endangered (North-east Atlantic)	Prohibited to fish for, retain, tranship, land in EU waters. Protected under the Wildlife & Countryside Act 1981.	Seasonal movements into the Celtic Sea where they are vulnerable to by-catch in fixed gill net fisheries.
Porbeagle 	*Lamna nasus*	Critically Endangered (North-east Atlantic)	Prohibited to fish for, retain, tranship, land in EU waters, and for EU vessels in all waters worldwide.	Reported by fishermen as being locally and/or seasonally abundant off the south west coast of the UK. High levels of unavoidable by-catch and dead-discarding can occur.
Spurdog 	*Squalus acanthias*	Endangered (North-east Atlantic)	Zero Total Allowable Catch (TAC) for this species.	Incidental by-catch of spurdog in mixed fisheries in the North-east Atlantic can be high. High levels of unavoidable dead-discarding could result in spurdog being a potential 'choke' species, if it remains a zero TAC species when subject to the landing obligation.

Potential solutions and impacts

Group discussion underscored that more research is needed to fully understand the levels and occurrence of interactions between threatened elasmobranchs and fishing gear, which can lead to by-catch and dead discards. **With more information on elasmobranch distribution and incidences of elasmobranch by-catch in UK waters, steps can be taken to reduce unwanted interactions with fisheries.** This will protect both fishers (from potential gear damage, time taken to disentangle by-caught species, and un-saleable catch) and the species themselves.

Shark By-Watch UK has identified a number of key areas for further consideration and research, based around the key species discussed at the recent collaborative Shark By-Watch UK 2 workshop. Opportunities for reducing elasmobranch by-catch centre around investment in the testing and use of new, innovative gears, technologies and approaches to management.

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A spurdog – one of the focal species of the participatory workshop – is measured and tagged during one of the project's field studies.

Common skate

To reduce by-catch of common skate, potential modifications to towed commercial fishing gear (i.e. otter trawl) were more easily identified than for static gear (i.e. gill nets). These included the possible use of selectivity grids and the removal of tickler chains on towed gear.

A fisher-focused code of conduct detailing the best practice for handling and releasing common skate was identified as a suitable method to promote 'live' discarding. The uptake of a code of conduct by the fishing industry could be incentivised by the prospect of a positive economic advantage by adopting best practice – for example a dedicated 'ecolabel' indicating where fisheries products are supplied by vessels adhering to such a code of conduct.

The collation of all available datasets for these species (e.g. all tag, observer, sightings and strandings data) to better understand movements, behaviour and distribution was also seen as an essential research priority.

Large sharks - basking sharks and porbeagle

The large size of basking sharks and porbeagle was seen as an advantage when considering solutions to reduce by-catch of these species in fixed, static commercial fishing gear, such as gill nets.

Fine monofilament mesh and individual panels joined by weak links to allow by-caught sharks to break-through and/or break free of entanglement in static gear was seen as a feasible approach for further consideration.

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The group dedicated to working on common skate during the project's workshop report back on their priorities for research and action.

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The collation of all datasets – including tag data – was identified as an important step in reducing large shark by-catch. Here, tags are ready to be used during a survey.

A further modification for consideration in reducing entanglement of basking sharks in creel ropes at the sea surface was the use of weak links in tensioned, non-buoyant creel ropes.

Another solution identified was to develop a self-reporting spatial avoidance scheme, with fishers reporting their basking shark or porbeagle by-catch. This would identify real-time by-catch 'hotspots' to avoid, which could be shared with the rest of the fleet.

The collation of all available datasets for these species (e.g. all tag, observer, sightings, and strandings data) was identified as an essential research priority, to further understanding of their behaviour, movements and distribution.

Spurdog

A selectivity grid was identified as a potential, viable gear modification to reduce spurdog by-catch in towed commercial fishing gear. For the demersal longline fishery, attraction devices such as electric decoys were considered a potential option.

A current UK trial was supported as an approach to reduce spurdog fishing mortality – a real-time, self-reporting spurdog by-catch avoidance scheme in which industry participants report, and subsequently avoid spurdog by-catch hotspots through avoidance measures for relatively small areas, and for limited periods.

Essential research priorities were identified: to quantify spurdog by-catch throughout the UK and to investigate long-term discard survival, through the deployment of electronic tags using a participatory tagging programme.

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A range of gear modifications were suggested for all species.

Recommendations

Participatory discussions between the fishing industry, science, Government policy representatives, NGOs, retail, and the wider supply chain have highlighted a broad need for more in-depth research into measures for avoiding by-catch of threatened elasmobranchs. A number of innovative potential solutions to this environmental, and economic issue have been identified. **The Shark By-Watch UK project now believes that the following areas need to be prioritised in future research around shark, skate and ray by-catch and discards.**

1) Ensure science and industry work together to make best use of the full range of knowledge and expertise available.

The Shark By-Watch UK project has been built upon participatory research principles; an inclusive method which has put fishermen and fishing communities at the heart of the project's work on elasmobranch by-catch. For participatory methods to work, equal credence must be given to the full range of 'knowledge types' involved in a research project.

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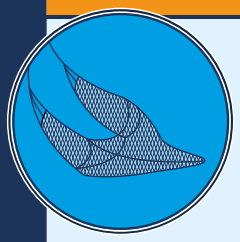
Participants at the ZSL co-hosted workshop examine a legally landed by-caught skate during a biological sampling.

2) Trial innovative technologies



A range of advancements in fishing gear technology may help reduce or prevent elasmobranch interaction with fishing gear. Innovations such as grids, deterrents, decoys and line modifications may be part of the solution to reducing by-catch of threatened sharks, skates and rays in UK waters. However, these technologies need to be proven in UK fisheries before they can be disseminated on a scale that will impact overall rates of by-catch. With this in mind, rigorous trialing of these technologies, with participation from willing fishermen, will provide a greater understanding of how they can best contribute to by-catch reduction in UK fisheries and will secure broader uptake in the long term.

Of particular relevance to UK fisheries in the Celtic Sea, are the following recommended trials:

(i) fine monofilament mesh and individual panels joined by weak links to allow by-caught porbeagle and/or basking shark to break-through and/or break free of entanglement in static gear.

(ii) the use of selectivity grids in otter trawls to allow common skate to escape capture.

(iii) the use of *weak* links in tensioned, non-buoyant creel ropes, preventing basking shark entanglement at the sea surface for creel fisheries around the Western Isles of Scotland.

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Newlyn harbour, Cornwall: home to a number of vessels taking part in Shark By-Watch UK's participatory survey and tagging programmes in the Celtic Sea.

3) Development of alternative management approaches

To be considered alongside innovative gear technologies are alternative approaches to fisheries management to lessen the likelihood of unwanted elasmobranch by-catch. In partnership with Shark By-Watch UK 2, a real-time **Spurdog By-catch Avoidance Programme** is being trialed in the offshore gill net fishery operating from the southwest of the UK, in the Celtic Sea. The trial is adapting a previously used format of Real-Time Closures (RTCs) for cod in the North Sea, and the highly successful real-time by-catch avoidance system in the US scallop fishery, allowing industry participants to avoid significant spurdog by-catch by adapting their fishing patterns and behaviour.

If the trial is successful, two additional UK fisheries have been identified where similar approaches could be developed:

(i) Southern North Sea (ICES Division IVc): The under-10 metre, demersal long-lining fleet in the southern North Sea primarily targets cod (*Gadus morhua*), thornback ray (*Raja clavata*) and bass (*Dicentrarchus labrax*). However spurdog is sufficiently common in the southern North Sea, both locally and seasonally between November and April, that the level of by-catch and discarding is significant.

(ii) Western Isles waters (ICES Division VIa): the nephrops bottom trawl fishery around the Western Isles of Scotland (Sound of Raasay and Inner Sound) experiences regular spurdog by-catch episodes during the period between October and January.

Shark strandings could provide an excellent opportunity to gather data on prohibitied species, such as porbeagle (seen here, landed under special scientific dispensation).

Fisher participation is crucial to the Shark By-Watch UK research process.

4) Full utilization of existing and novel data sources

Better data leading to a more comprehensive picture of elasmobranch populations in UK waters is vital in both reducing discards of threatened sharks, skates and rays, and in determining sustainable catch levels in targeted elasmobranch fisheries. On-going research in this area is crucial to ensure the health of elasmobranch populations.

Two recommendations to increase available data are:

(i) Collation of all available basking shark datasets (e.g. all tag, observer, sightings, and strandings data) could be used to identify 'hot-spot' areas for basking sharks off the Western Isles, Irish & Celtic Seas. Using Vessel Monitoring System data and fisher knowledge, **areas for potential basking shark - fishermen interactions could be identified,** raising awareness and preempting voluntary avoidance of these areas by commercial fishing vessels, **reducing unwanted by-catch.**

(ii) Shark strandings offer a novel opportunity to collect biological data and samples to further our understanding of sharks. Although shark strandings are encountered by the UK Cetacean Strandings Investigation Programme (CSIP), there is no coordinated strategy for collecting stranded shark data and biological samples, other than for basking shark, like that available for cetaceans. **The inclusion of all stranded sharks into CSIP offers a unique opportunity to collect data for sharks such as porbeagle,** which due to their prohibited status can no longer be collected by traditional means – i.e. they can no longer be caught and landed for scientific study.

5) Understanding long-term discard survival for the reformed CFP

To quantify whether live-discarding of sharks, skates and rays is more beneficial to the overall population of these species than retaining by-caught individuals on board as part of the landing obligation, clear evidence is required. Defra is working to gather sufficient evidence to support 'high survivability exemptions' for when elasmobranch species are included under the landing obligation. It is important that scientists and fishermen continue to work together in gathering the necessary evidence. Electronic tagging programmes can be used to determine levels of post-discard mortality to help develop a clearer picture of the potential benefits of live-discarding.

Unlike short-term tank based studies, tagging live discards with electronic tags can quantify the increased levels of predation and long-term stress or injury-induced mortality that may be associated with the 'live' discarding process. **These data could be used to help quantify the impact that the commercial fishing sector has on threatened elasmobranchs, and quantify long-term discard survival.**

Conclusion

By incorporating stakeholders from a range of backgrounds in the Shark By-Watch UK 2 project, a number of clear priorities have been identified with the potential to reduce by-catch and dead discards of threatened sharks skates and rays. By involving all relevant stakeholders, especially fishers, there is buy-in to the recommendations and strong potential for future engagement in taking forward the 'recommendation', especially those involving gear trials with the fishing industry.

Glossary

By-catch: The portion of a commercial fishing catch that consists of marine animals caught unintentionally.

Choke species: Species for which there is minimal or zero TAC which have the potential to become 'choke' mixed fisheries, whereby it forces fishermen to stop fishing altogether in those areas or tie-up their vessels.

Common Fisheries Policy (CFP): The fisheries policy of the European Union. It sets TACs (mostly annually) for key species, for EU member states, as well as encouraging the fishing industry by various market interventions.

Discarding: The process by which fishers throw unwanted catch back into the sea.

Elasmobranch: Sharks, skates and rays are known collectively as elasmobranchs. Elasmobranchs are a group of fish characterised by cartilaginous - not bony - skeletons, 5-7 gill openings on each side and several rows of teeth which are continually replaced, amongst other distinct traits.

Landing obligation (discard ban): New regulation within the reformed CFP where fishers will have to land all their catch of TAC species.

Participatory research: Collaborative research between a range of stakeholders, where different knowledge types are given equal credence within the design, implementation and analysis of the research - insofar as is possible - by all stakeholders.

Prohibited species: Species prohibited for EU and 3rd country fishing vessels to fish for, retain on board, tranship or land.

Shark By-Watch UK: A research initiative established in 2011 and led by the Centre for Environment, Fisheries & Aquaculture Science (Cefas) where fishermen and scientists work together to improve fishing practices and knowledge for sustainable shark, skate and ray fisheries.

Stakeholders: An organisation or individual with a particular interest or concern in a given topic. Here used to refer to any individual with a 'stake' in the Shark By-Watch UK project, or related fisheries, markets and supply chains.

Threatened species: The International Union for Conservation of Nature (IUCN) categories of Vulnerable, Endangered or Critically Endangered species.

Total allowable catch: Total allowable catches (TACs) are catch limits (usually expressed by weight) that are set for most commercial fish stocks across the EU. TACs are set annually for most stocks.

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