HAULING UP SOLUTIONS

REDUCING CETACEAN BYCATCH IN UK FISHERIES

WORKSHOP REPORT

MONITORING • REDUCTION • BYCATCH •

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CHATHAM HOUSE RULE

This report gives a summary of a participatory workshop on cetacean bycatch held at the Zoological Society of London (ZSL) on 12-13 March 2019 held under the Chatham House Rule. As a result, no comments are affiliated to any individual or organisation apart from direct quotes, for which permission was sought.

Cefas

Department for Environment Food & Rural Affairs

ZSL LET'S WORK FOR WILDLIFE

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MINDFULLY WIRED COMMUNICATIONS

SECTION ONE

SUMMARY

- Accidental capture in fishing gear (bycatch) is one of the greatest threats faced globally by cetaceans (whales, dolphins and porpoises) and has contributed to the decline and extinction of some populations and species[1].

- Cetacean bycatch is problematic as it represents a **welfare issue** for individuals caught which is of **public concern**; an **economic cost** to fishermen owing to the time taken to clear and repair damaged gear, and the subsequent lost catch; an **issue of safety** for fishermen when clearing nets; as well as a potential **conservation concern** for some species or populations.

- In order to tackle cetacean bycatch in UK waters, the UK Government is developing a coherent and coordinated, stakeholder-led approach to minimise cetacean bycatch. The Centre for Environment, Fisheries & Aquaculture Science (Cefas) is leading this initiative through collaborative partnerships to improve monitoring of cetacean bycatch and implement practical mitigation measures (bycatch reduction techniques).

- The innovative ***Hauling Up Solutions*** workshop held on 12-13 March 2019 jointly with Cefas, the Zoological Society of London (ZSL) and Department for Environment, Food & Rural Affairs (Defra) is part of this collaborative approach. It involved fishermen from England and Scotland representing a range of catching methods; scientists; technologists; policy-makers; and environmental NGOs.

- This inclusive approach has led to recommendations that represented the majority of participants' views on future monitoring and mitigation of cetacean bycatch in UK fisheries. These recommendations, summarised in this report, are put forward to support the UK in reaching its international commitments to bring cetacean bycatch to as close to zero as possible.

- Defra and Cefas have set out their next steps for action on these recommendations.

[1]FAO (2018); Rojas-Bracho *et al* (2019)

SECTION TWO

BACKGROUND

The UK Government has the ambition to tackle cetacean (whale, dolphin and porpoise) bycatch (accidental capture in fishing gear) in UK waters through a coordinated stakeholder-led approach and implement practical methods to better monitor and avoid bycatch.

REDUCING CETACEAN BYCATCH PROJECT

The ***Reducing Cetacean Bycatch*** **project**, funded by Defra and facilitated by Cefas, is working with experts and stakeholders to:

- ✔ **Engage** with relevant stakeholders and develop collaborative partnerships
- ✔ **Improve** understanding of cetacean bycatch within UK commercial fisheries
- ✔ **Identify** ways to better monitor and mitigate bycatch
- ✔ **Trial** approaches to reduce bycatch

At its core the project focuses on **monitoring** and **mitigation** to **reduce** cetacean bycatch.

"Within this workshop and project, we want to bring together perspectives from all the different groups - fishermen, scientists, engineers, software developers and environmentalists - exchange experiences, break down barriers and understand each other's perspectives. Through collaboration we will identify better ways to monitor and reduce cetacean bycatch."

Stuart Hetherington, Cefas
Project lead: Reducing Cetacean Bycatch Project

PARTICIPATORY WORKSHOP

The ***Hauling Up Solutions*** workshop held in March 2019 at the Zoological Society of London was at the heart of this collaborative approach, providing a shared basis on which to guide the project and policy direction for Defra.

"Defra will take forward the specific recommendations from this workshop to develop more comprehensive monitoring techniques and more effective mitigation measures."

Catherine Bell, Defra

The Hauling Up Solutions Workshop brought together a wide range of stakeholders at ZSL London Zoo.

SECTION TWO

WORKSHOP OBJECTIVES

The aims of the workshop were to:

- **Share Knowledge** – Share perspectives and bring together fishermen, scientists, technologists, conservationists and policy-makers.
- **Collaborate** – Build on relationships with different stakeholders and continue to work together to identify practical, affordable and effective next steps.
- **Innovate** – Explore practical options for monitoring and mitigating cetacean bycatch around the UK.
- **Envision** – Develop strong clear recommendations on future research to monitor and reduce cetacean bycatch.

STAKEHOLDER PARTICIPATION

The workshop sought to shed new light on the issue of cetacean bycatch in the UK; bringing together a wide range of stakeholders to promote constructive dialogue across a broad spectrum of views. The participants invited to the workshop included shellfish and finfish fishermen from Scotland and England, academic and government scientists, gear technologists, as well as NGO and industry representatives (Page 5) – stimulating discussions to enable a better understanding of each other's perspectives. Fishermen, who are directly affected by this issue, were at the heart of the discussion on how to better monitor and mitigate cetacean bycatch.

STAKEHOLDER MOTIVATIONS

At the beginning of the workshop, participants were asked:

1. **Why** are you here?
2. **What** outcome do you want?
3. **How** do you want to get there?

SECTION TWO

STAKEHOLDER MOTIVATIONS FOR PARTICIPATING IN THE WORKSHOP

Across the participants, there were aspirations to work cooperatively, share and understand each other's opinions and guide solutions through a collaborative approach based on evidence. Although there was differing opinions on the rate and level of change, there was a deep commitment within the room for genuine action to drive down cetacean bycatch in UK commercial fisheries.

FRAMING THE DISCUSSION: POLICY QUESTIONS

Participants were also asked to consider a series of more detailed questions during the workshop to stimulate thinking around action-orientated policies that could be employed in the UK context. These were:

Monitoring

- How can we use new/different methods to complement existing monitoring and create a more complete picture of bycatch in the UK?
- How can we use monitoring efforts to support evaluation of the effectiveness of mitigation measures?
- Are there innovative/new monitoring techniques that could be developed given the right investment?

Mitigation

- How effective is our current 'tool box' for mitigating bycatch in the UK?
- How can we build on existing mitigation measures to make them more effective?
- Are there innovative mitigation measures that could be developed given the right investment?
- What barriers are there to bringing forward new/additional mitigation?

SECTION TWO

WORKSHOP CONTENT

The workshop provided a mutual foundation of knowledge through a series of talks that introduced the issue and provided an overview of monitoring and mitigation options. This allowed for detailed discussion around the policy-focused questions. Across the two days of joint-working, participants engaged in an evaluation of the strengths, weaknesses, opportunities and threats (SWOT) of the different monitoring and mitigation methods presented; and key recommendations were developed through group and plenary discussions.

Fishing

- Cornish Sardine Management Association (CSMA)
- Fishermen: with representation from net fishers in Cornwall & creel fishers in Scotland
- National Federation of Fishermen's Organisations (NFFO)

Technology

- Anchorlab
- Arribada Initiative
- AST Marine Science
- Chelonia
- Fishtek Marine
- IRNAS
- Octophin
- SafetyNet Technologies Ltd

Environmental NGOs

- ClientEarth
- Cornwall Wildlife Trust
- International Whaling Commission (IWC)
- Marine Stewardship Council (MSC)
- Orca
- Science Gyre
- Shark Trust
- Whale and Dolphin Conservation (WDC)
- World Wildlife Fund (WWF)
- Zoological Society of London (ZSL)

Science

- Centre for Environment, Fisheries & Aquaculture Science (Cefas)
- Cetacean Strandings Investigation Programme
- Institute of Zoology
- Marine Science & Communication
- New England Aquarium, US
- Sea Mammal Research Unit
- Sea Mammal Research Unit Consulting
- Scottish Marine Animal Stranding Scheme
- University of Aberdeen
- University of Bristol
- University of Cambridge
- University of Exeter
- Université de La Rochelle, France
- University of St Andrews (Sea Mammal Research Unit)
- University of Portsmouth
- Wageningen University, Netherlands

Policy advisors & governmental organisations

- ABPMer
- Department for Environment, Food & Rural Affairs (Defra)
- Joint Nature Conservation Committee (JNCC)
- Marine Management Organisation (MMO)
- National Commission on Biodiversity, Mexico
- Natural England

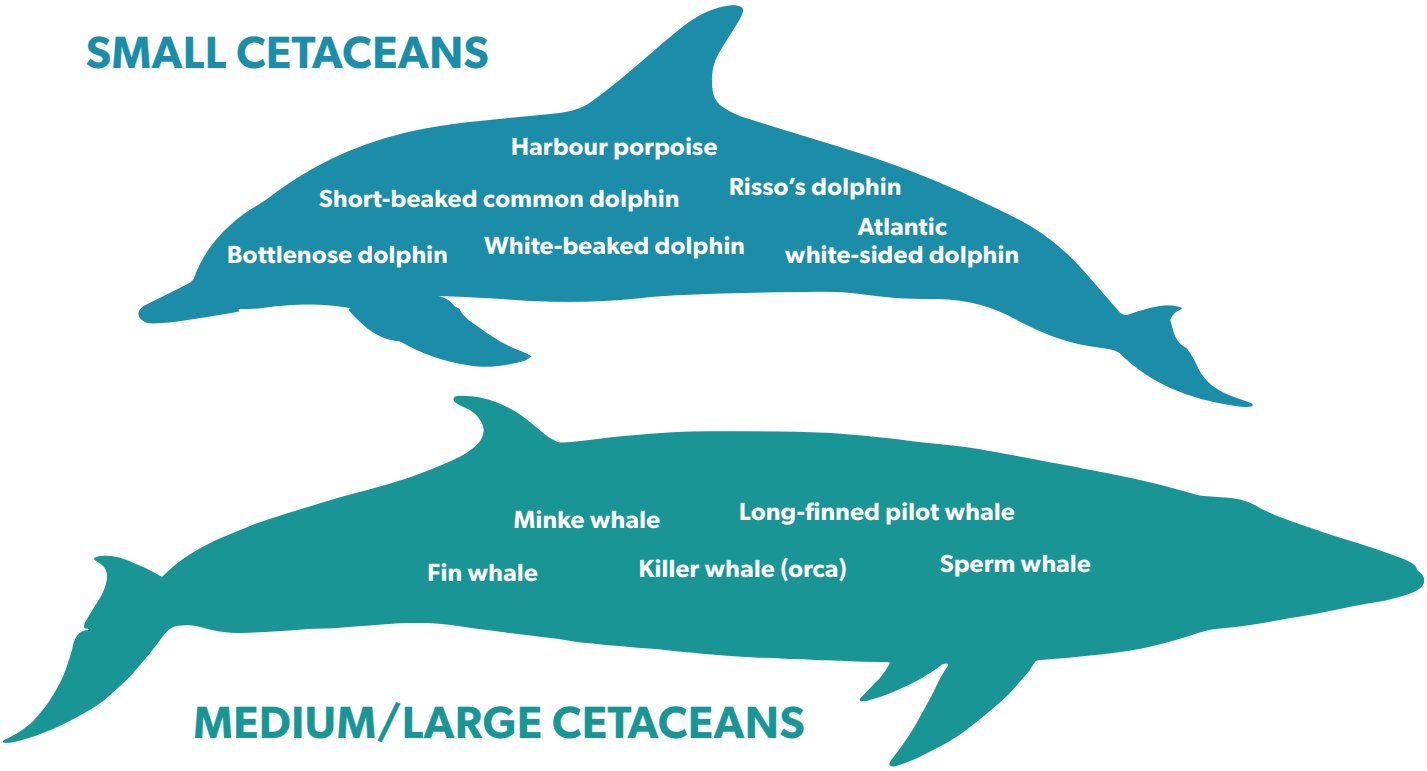
The speakers at the workshop came from a wide range of backgrounds, as listed above, sharing a wealth of expertise. These presentations are referenced as 'WP1-27' (workshop presentation 1-27) throughout the report, with a full list on page 30. Note: Organisations listed alphabetically under categories.

SECTION THREE

INTRODUCTION TO THE ISSUE

CETACEANS WITHIN UK WATERS

Regularly occurring whales, dolphins and porpoises around the UK coast are shown below.



The seas around the UK provide a varied habitat for over twenty species of cetaceans, of which eleven occur regularly (Defra, 2010).


Common dolphin.


Harbour porpoise.

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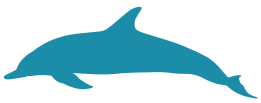
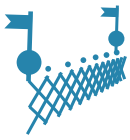
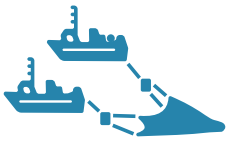
CETACEAN BYCATCH

In the UK, the most common interactions between cetaceans and fishing gear involve:

- Small cetaceans (e.g. harbour porpoises and common dolphins) caught in nets (e.g. different types of gill nets and pelagic trawls), and
- Entanglement of medium/large cetaceans (e.g. minke whales) in ropes (e.g. lines that rise to the sea surface from the pots on seabed, known as risers)

In addition, there are also some small, fragmented or isolated cetacean populations of whales and dolphins around the UK where bycatch may be a rare event, but each lost individual may have a significant impact to the population. These include but are not limited to:

- Inshore groups of bottlenose dolphins; and
- Killer whales off the west coast of Scotland.

		FISHING GEAR	INTERACTION
CAUGHT IN NETS			Dolphins and porpoises may be accidently caught in static gear.
			Dolphins and porpoises may actively swim in and out of towed gear and get accidentally caught.
ENTANGLED IN LINES			Whales may get entangled in ropes that attach pots or static gear to marker buoys at the sea surface.

SECTION THREE

KEY IMPACTS OF CETACEAN BYCATCH WITHIN THE UK

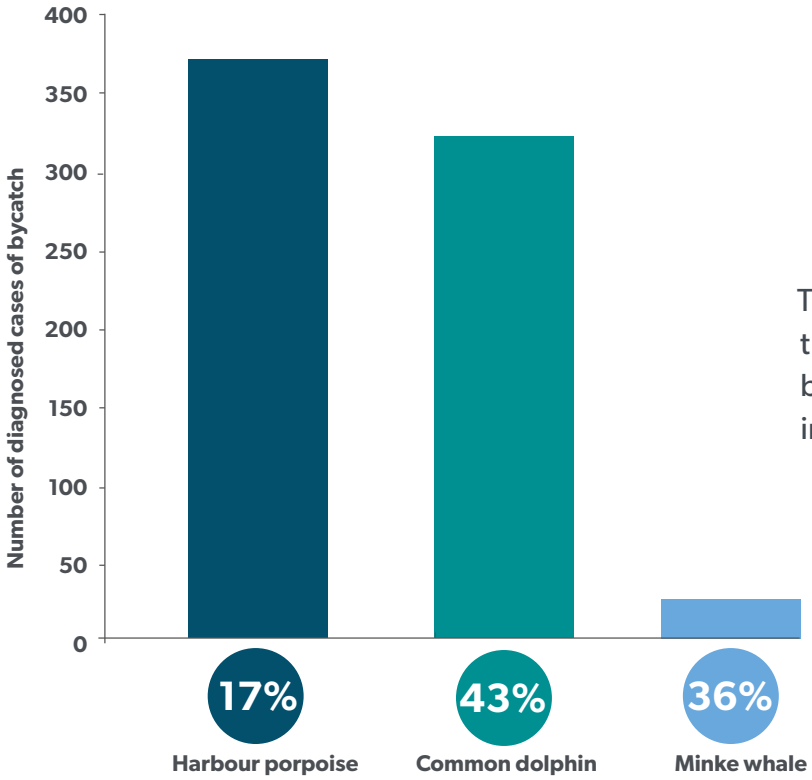
There are three main concerns associated with cetacean bycatch in the UK:

1) Economic impacts and safety concerns for the fishing industry: These include costs and gear damage associated with entanglement; down-time when clearing and repairing gear; safety issues when releasing animals from nets and lines; and reduced market access where buyers are looking for sustainability assurances. [WP4]

2) Welfare implications and public concern: Cetaceans get caught or entangled in nets and lines, and suffocate when they are unable to resurface to breathe. Examinations on stranded cetaceans reveal the significant welfare implication of cetacean bycatch which is of public concern. [WP7, WP16]

3) Conservation considerations: Mortality due to bycatch can impact cetacean populations, particularly in the case of small isolated populations such as that of bottlenose dolphins in southwest England and killer whales resident off the west coast of Scotland. [WP7]

Bycatch or entanglement has affected a wide range of cetacean species in the UK, with at least one diagnosed case in fourteen of the nineteen cetacean species examined by the UK strandings programme between 1990 and 2017. Bycatch/entanglement was most frequently diagnosed in stranded harbour porpoises, common dolphins and minke whales. [WP7]



The graphic, provided by ZSL, illustrates the number and percentage of diagnosed bycatch cases among stranded cetaceans in the UK, between 1990-2017.

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UK COMMITMENTS ON CETACEAN BYCATCH

The UK has international commitments to bring cetacean bycatch to as close to zero as possible. This includes commitments to the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) and the EU Common Fisheries Policy (CFP) regulation (EC) 812/2004.

Flash workshop event: Dissection of a harbour porpoise

A unique opportunity was provided at the workshop to witness a necropsy (dissection) of a bycaught harbour porpoise, as part of routine work undertaken by ZSL within the UK Cetacean Strandings Investigation Programme (CSIP). Every year around 800 cetaceans strand around the UK coast. Across all cetaceans examined in the programme, bycatch was determined as the cause of death in 20% of all cases (CSIP database, 1990-2016), although the levels varied between species. Bycatch therefore may be seen as the single largest direct man-made driver of mortality in UK stranded cetaceans.

The criteria for determining bycatch are well established in the UK, and include:
1) Presence of net marks or other external evidence of interaction with fishing gear;
2) Animals generally in good nutritional condition and having died acutely;
3) Sometimes evidence of internal trauma;
4) Usually evidence of recent feeding; and
5) Elimination of other significant underlying issues.

Post-mortem examinations on cetaceans not only reveal information on causes of death and the threats they face, but can also help us to learn more about their lives.

"It was interesting to learn about all the various techniques that are used to try and work out how the animal died. It is quite amazing to see what can be detected from so many different parts of the anatomy."

Dale Rodmell, National Federation of Fishermen's Organisations

SECTION FOUR

MONITORING

WHAT'S IN THE TOOL BOX FOR MONITORING CETACEANS?

There are a range of available methods for monitoring cetacean abundance and bycatch, and many of these were presented at the workshop; some are used in routine data collection and others are in development.

Participants heard a range of expert presentations on monitoring methods to capture data on cetacean-fishery interactions.

Observer programmes, covering between 0.5 and 5% of UK commercial fishing activity (Box), are currently among the main sources of data used to calculate bycatch rates and identify bycatch hotspots in UK waters. In addition, strandings and necropsy data provide a 30-year data set identifying the species, location, and proportion of individual strandings caused by bycatch.

Observer programmes monitoring cetacean bycatch in the UK

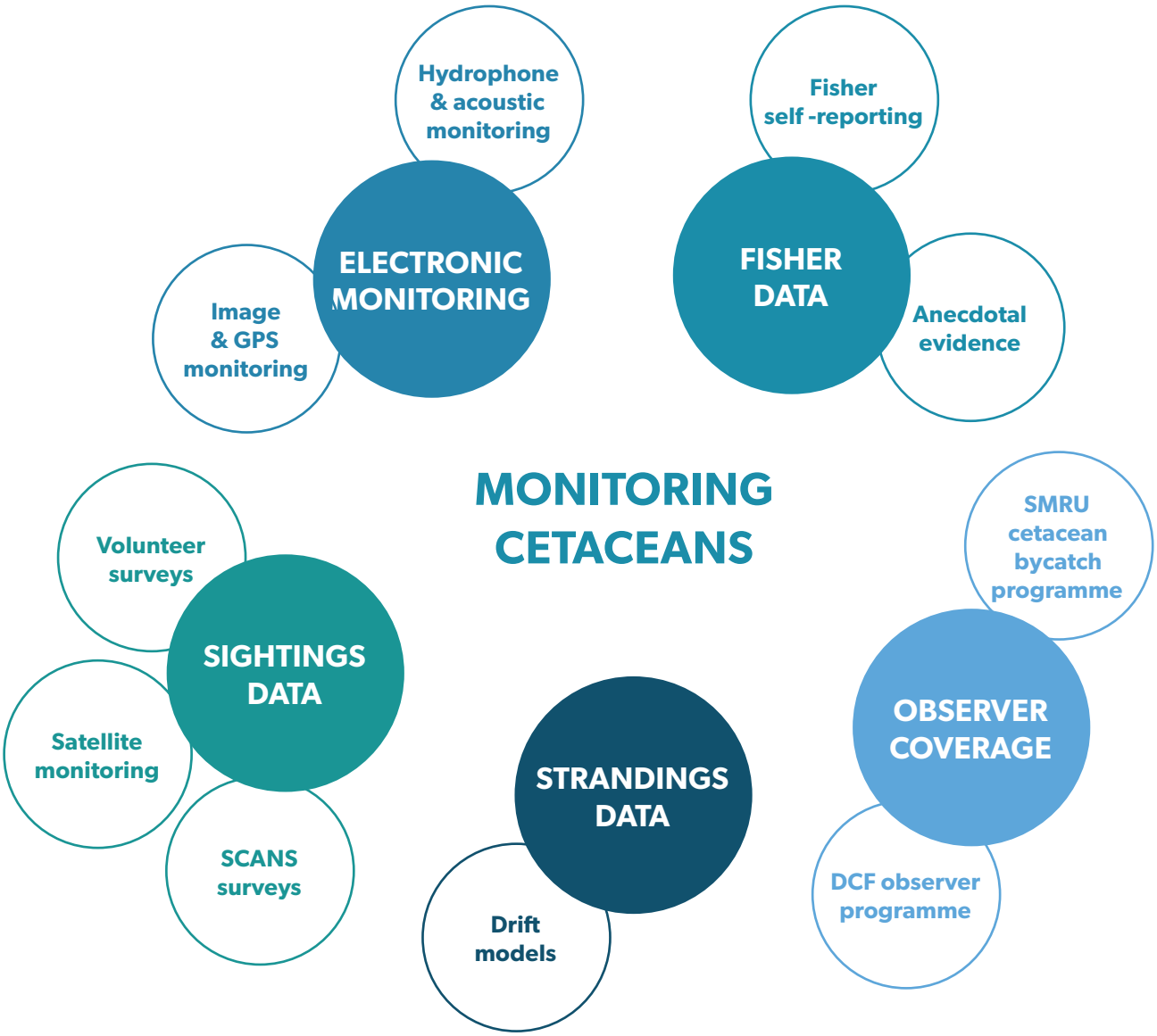
The Sea Mammal Research Unit (SMRU) at the University of St Andrews coordinates a dedicated protected species bycatch monitoring programme, which collects data from fishing vessels on cetacean and other protected species bycatch from a range of fisheries around the UK to meet the requirements of the Common Fisheries Policy (CFP), EC Regulation 812/2004, the Habitats Directive, and the International Convention for the Regulation of Whaling (ICRW). The programme focuses primarily on gear types with a high perceived or known risk of protected species bycatch. Sampling coverage varies depending on gear type but typically ranges from 0.5 - 5% of annual fishing effort by the relevant fisheries.

The EU Data Collection Framework (DCF) – Regulation 2017/1004 obliges all marine states to carry out catch sampling programmes. In the UK, England, Wales, Scotland and Northern Ireland have their own national programmes and the programme for England and Wales is conducted by Cefas. Although the primary aim is to collect catch rates and biological data for all commercial fish species, biological data on all incidental bycatch, including cetacean bycatch, is also collected. The programme's sampling effort is randomly stratified across the fleet, so that the Cefas programme provides baseline representative data for all fleets and areas, covering the same fisheries focused on by SMRU. Comparisons with the results of the SMRU programme in England and Wales, where the focus is on specific fleets in high risk areas of protected species bycatch would be useful to better interpret the results from each programme, identify potential biases and help improve both sampling designs if needed. WP8 & WP12

SECTION FOUR

There are further data sources that offer opportunities to increase monitoring coverage across the UK commercial fishing fleet, if these data can be effectively validated. These are not yet used routinely to estimate bycatch rates. These methods include: fisher self-reporting, electronic monitoring (EM), acoustic monitoring and the collection of anecdotal data through interviews. There are also sources of sightings data and the Small Cetaceans in European Atlantic waters and the North Sea (SCANS[2]) surveys that provide indications of abundance and distribution.

The range of data streams for monitoring cetacean abundance and bycatch:



[2] A large-scale ship and aerial survey to study the distribution and abundance of cetaceans in European Atlantic waters coordinated by the University of St Andrews in Scotland, with partner institutes from other supporting countries: https://synergy.st-andrews.ac.uk/scans3/

SECTION FOUR

KEY CHALLENGES

Key issues associated with monitoring cetacean bycatch include:

- **Gaps in data collection:** most bycatch incidents go unreported and observer programmes currently cover less than 5% of UK fishing operations;
- **Lack of integration:** monitoring streams are not brought together to provide an overarching and verifiable picture; and
- **Challenges for small-scale fisheries**: on smaller vessels, space is a limiting factor when accommodating observers onboard.

STRENGTHS, WEAKNESSES, OPPORTUNITIES & THREATS

Workshop participants undertook a SWOT analysis, teasing out the strengths and weaknesses of a range of monitoring methods. They concluded that integration of these different methods is vital. For example, high quality data can be collected from a small sample of the fleet - through observer programmes and strandings data - to identify potential hotspots; with fisher self-reporting to increase sampling coverage and electronic monitoring to verify fishermen's reports.

Participants discussed strengths and weaknesses of different monitoring options.

SECTION FOUR

SUMMARY OF SWOT ANALYSES ON MONITORING METHODS

Example monitoring options	Key strengths & opportunities	Key weaknesses or threats
Observers	+ High quality data: use to verify other monitoring streams + Builds relationships with fishermen	– Resource intensive – Low coverage of the fishing fleet
Strandings investigation with drift modelling	+ Monitors multiple pressures beyond bycatch and collects ancillary data + Supports public engagement + Could promote engagement with fishermen through tagging	– Resource intensive – Uneven effort across the UK & subset of mortality and strandings – Modelling requires good data or it will give misleading results
Fisher interviews	+ Builds relationships and trust with fishermen + Easy to replicate	– Resource/time-heavy – Subjective view of interviewee
Real-time reporting	+ Enhances collaboration across the industry + Preventative measure to avoid bycatch	– Sharing commercially sensitive information – Requires incentives to ensure buy-in
Apps & technology	+ Reduces duplication of data entry and burden on fishermen + Open source software: can be more effective and efficient	– Integrity of data – requires validation – Reluctance to share data
Electronic monitoring (EM)	+ Captures large amount of information + Verifies fisher self-reporting	– Trust in data use (science vs compliance) – Obstruction or issues with cameras
Hydrophones	+ Assesses levels of overlap between fishing and cetaceans + At-source monitoring by fishermen	– Only useful for species that vocalise frequently – Gives presence and absence of individuals rather than a bycatch rate
Satellites	+ Covers large areas + Ability to reach otherwise inaccessible areas	– Poor weather may obscure images – Only visible for larger animals e.g. whales
Remote operating vehicles (ROVs)	+ Can reach inaccessible areas + Could be used together with hydrophones	– No previous use for monitoring bycatch – Regulations may hinder use

Notes: See recommendations for participants' ideas on future monitoring efforts. This table summarises the key points of the more detailed SWOT analysis undertaken by participants available to view at: www.cefas.co.uk/cetacean-by-catch-workshop/

SECTION FIVE

MITIGATION

WHAT'S IN THE TOOL BOX FOR REDUCING CETACEAN BYCATCH?

A range of measures to reduce cetacean bycatch already exists. Many of these were presented during the workshop, ranging from acoustic deterrents through to gear modifications, as well as time-area closures and the innovative use of differing light frequencies to attract or deter animals to or from nets. Generally, specific methods are effective for some but not for all species, and the effectiveness of different methods is also specific to the fishing-gear or is still in development. The table gives examples drawn from the workshop presentations and a technical workshop review conducted by the UN Food and Agriculture Organisation (FAO) in 2018.

Species	Sound	Gear		Time-area closures	Light
		Modifications	Deployment		
	Pingers have been shown to be effective for harbour porpoise & striped dolphin. FAO, 2018; WP25	Gill net tie-downs used along the East Coast of the US to reduce porpoise bycatch in gillnets FAO, 2018 Use of top escape hatches to allow air-breathing dolphins to leave trawl nets WP1	**Example**: Cornish ring net fishermen can drop the headline to release the catch and allow dolphins and porpoises to swim over the head rope WP4 **Example:** New Zealand deep-water trawlers encouraged to avoid manoeuvres which collapse the net FAO, 2018	**Example**: Gill net closure on the US east coast triggered if porpoise bycatch reaches a certain level FAO, 2018	**In development:** Could be used to increase target catch and reduce soak times (e.g. with gillnets which may reuce bycatch risk) WP13
	Pingers have been shown to be effective for common dolphin in some trials but not others. FAO, 2018; bycatch.org				
	Pingers do not appear to be effective for bottlenose dolphins that depredate. FAO, 2018; WP25				
	Pingers not generally used to deter whales (e.g. humpback) FAO, 2018 but effective in trials for minke whales in offshore wind construction sites so may play a role.[C]	**Example**: Red and orange ropes found to be more visible to whales, helping avoidance. WP26 **Example**: Rope-less lobster and crab pots used in New South Wales crab fishery FAO, 2018	**Example:** Less slack rope deployed or stiff ropes (e.g. US west coast) FAO, 2018	**Example:** Mexico gillnets banned from December 15 to March 15 to protect gray whales FAO, 2018	**In development:** Targeted light wavelengths could be used to alert whales to presence of lines WP13
	**Example**: Acoustic harassment devices used to keep seals away from aquaculture farms. FAO, 2018	**Example**: Gear changes are the basis of projects on improving gear selectivity and reduce bycatch and discards e.g. by Seafish and the EU-wide project 'GearingUp'[A].		**Example**: Real-time monitoring used to avoid salmon bycatch in US, and trials begun for demersal bycatch in Scotland. WP15	**In development:** Has been tested to reduce prawn bycatch WP13

SECTION FIVE

KEY CHALLENGES

Currently, the key issues associated with mitigation methods include:

- **Cetacean-gear interactions:** Fishermen and cetaceans often 'target' fish in the same areas, therefore some interaction between fishing gear and cetaceans is almost inevitable. For fishermen there is always the challenge to mitigate cetacean bycatch without compromising the effectiveness of fishing and their resulting catch.

- **One size doesn't fit all:** What works well in one situation does not always work elsewhere. Pingers have been found to work for harbour porpoise in some circumstances, but not for bottlenose dolphin. Similarly, rope-less pots designed to avoid whale entanglement can be viable where potters have exclusive access to an area, but prove impractical at locations where pots need to be marked by buoys at the sea surface, so they are avoided by trawl vessels.

- **Lack of information sharing:** www.bycatch.org and a recent FAO Technical Report (FAO, 2018) are valuable resources that bring research on bycatch into one place. More needs to be done to share existing knowledge effectively within the UK context.

- **Challenges for small-scale fisheries:** The cost of mitigation measures - both initial and maintenance costs - may be prohibitive. There are also often variations in the way fishermen deploy their gear, meaning that one mitigation measure may work for one vessel or during one season, but not for another vessel or different season.

STRENGTHS, WEAKNESSES, OPPORTUNITIES & THREATS

Workshop participants undertook a SWOT analysis of mitigation measures, capturing the key strengths and weaknesses of each method and outlining potential areas of future research. It was highlighted that different methods may need to be combined. In addition, the deployment of devices, maintenance of devices, as well as ongoing application are important considerations.

Participants discussed strengths and weaknesses of different mitigation methods.

SECTION FIVE

SUMMARY OF SWOT ANALYSES FOR MITIGATION METHODS

Mitigation Option	Strengths	Weaknesses	Potential Future Research
Sound *Acoustic deterrent devices (ADDs) or pingers*	+ Works for some species in some areas, although needs to be assessed on a case-by-case basis + Scalability	– Can alert species attracted to feed from fish caught in the gear ('Dinner bell effect') – Difficult to enforce and maintain	1. Research into acoustic reflectors, and into interactive devices that can record and emit sounds 2. Trials for different species, populations, habitats, gears and seasons using current evidence base to select options (plus effectiveness of ADDs in >12m fleet, where they are mandatory, needs to be assessed)
Gear modifications *Changes to type, design or deployment of gear*	+ Successful changes to gear that requires minimal changes to fishers' practices + Resources on gear modifications available: www.bycatch.org	– Gear change or modification may impact another species/ ecosystem – Gear change might reduce target catch	1. Trials of different gear options and optimal deployment: soak time, location, coloured rope, tension in risers, escape hatches 2. Involve fishers in designing innovations
Spatial & temporal management *Fixed and non-fixed closures during certain times or places*	+ Can be flexible and dynamic + Adaptable on a case-by-case basis	– Can displace fishing effort or loss of fisher income if core area closed – Closed areas rely on good enforcement or can attract illegal fishing	1. Trial in identified hotspots 2. Test with real-time monitoring to make closures targeted and brief
Light *Lights based on species-specific wavelengths*	+ Lights could be used to increase the target catch and reduce the time the fishing gear needs to be in the water (and therefore the risk of interactions with cetaceans) + Species-specific – targeted	– Further evidence needed to assess if light can reduce cetacean bycatch – Need different lights for different species	1. Assess how applicable to different gears and species 2. Research impact of using lights on the wider ecosystem

Note: This table summarises the key points of the more detailed SWOT analysis undertaken by participants available to view at: www.cefas.co.uk/cetacean-bycatch-workshop/

SECTION SIX

RECOMMENDATIONS

During the workshop, invited stakeholders discussed options and proposed recommendations for future monitoring and mitigation approaches in a UK context as well as overarching guiding principles. The following provides a summary based on written content captured during the event.

OVERARCHING PRINCIPLES

1) Incentivise collaboration with the fishing industry and all stakeholders

• Collaborate with each other

Collaborate across all stakeholder groups to achieve the shared objective of reducing cetacean bycatch to the lowest level possible while allowing fishing to continue and remain viable.

"We see cetaceans every day and there has to be an acceptable level of bycatch, as accidents happen. However, anything that can bring bycatch down that's cost effective has to be good. That's why we're here: no one wants to see them in their nets."
David Bond, fisherman, Cornwall

• Design incentives for collaboration of the fishing industry in monitoring and mitigation

The fishing industry needs clear incentives to collaborate on monitoring and mitigation. They also need assurances that better reporting will not lead to arbitrary controls or punitive legislation, but rather targeted measures where they are most needed. Incentives can be created both through clear regulation and application of rules; and through opportunities such as increased quota or exclusive access to areas.

• Explore opportunities for fish buyers to support incentives

Involvement of the wider supply chain can help to incentivise change. For example, in situations where fish-buyers require assurances of sustainable fishing, monitoring and mitigation becomes a condition of market access.

Example of involving the wider market

Involvement of processors and buyers in the Cornish Sardine Management Association (CSMA) has driven Marine Stewardship Council (MSC) certification and required a better understanding of cetacean bycatch through a self-sampling programme, dedicated observer trips and recent deployment of acoustic hydrophones.[WP4]

OVERARCHING PRINCIPLES

2) Bring monitoring and mitigation together

• Balance the need for more information with the need to act

Mitigation tools are available and although there can be challenges in their application and information gaps remain, action does not necessarily need to be hindered by waiting for additional evidence. Reducing bycatch in a scientifically robust manner, allowing the evaluation of any such mitigation, can achieve a balance between gathering more information and taking action.

• Bring together monitoring and mitigation measures to more effectively reduce bycatch

Bringing together information from monitoring and mitigation would facilitate sharing of information and result in a more cohesive and coordinated approach across the UK. Furthermore, monitoring and mitigation do not need to be distinct: for example, real-time monitoring can be used as a method to prevent bycatch[WP16] and potential acoustic devices were suggested in group sessions that can both monitor and emit sounds interactively.

• Develop a digital hub to bring together all information that needs to be shared

A digital hub would provide a means to share information and guidelines on both monitoring and mitigation of cetacean bycatch.

3) Work across boundaries: "We share our waters"

• Collaborate across the UK and our EU and non-EU neighbours

The UK needs to work across England, Wales, Scotland, Northern Ireland and with EU and non-EU neighbours. We share our waters and a strategic approach is needed to protect and monitor cetacean populations that move across these borders.

"The focus of effort needs to be on collective action and finding the opportunities for effecting change across the administrative boundaries of the UK and with all the countries with which we share our waters."

Rodney Anderson, independent consultant
(former Director of Marine and Fisheries, Defra)

Experts in programming spoke of the need to create and harness 'open source' technologies to support environmental solutions.

SECTION SIX

MONITORING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1) Involve the fishing industry

- **Design and conduct monitoring in collaboration with the fishing industry to collect more detailed information on cetacean bycatch and abundance**

Enable the fishing industry to be at the heart of future monitoring, both actively through self-reporting and tagging; or passively through automated data collection devices. With a better understanding of where and when bycatch occurs it would be possible to roll-out additional monitoring that complements the current observer programmes.

Options for collaborative monitoring with the fishing industry

- ✔ Support **fisher self-reporting** using the latest technology (e.g. open-source apps) for maximum ease.
- ✔ Engage the fishing industry in the **tagging** and tracking of where dead bycaught animals drift. These data can be used to develop models of where stranded cetacean bycatch originates.
- ✔ Work with fishers to deploy **acoustic hydrophones** to pick up and track cetacean calls underwater. These can be used to monitor presence of cetaceans mapped alongside fishing activity to illustrate areas of overlap.
- ✔ Deploy current **electronic monitoring** systems and develop smaller systems (e.g. dash-cams) that may be used for inshore vessels and help verify fisher reports.
- ✔ Deploy **drone-operated cameras** in and around fishers' lines and nets to observe how cetaceans behave around the fishing gear.

The benefit of putting the fishing industry at the heart of planning, developing and implementing monitoring measures is to achieve buy-in from the outset on how best to reduce bycatch. Incentives need to be clear so that fishermen are motivated to take part.

"We see dolphins and porpoises everywhere: from October right through to April. In the last few years we've seen more bluefin tuna. You get these feeding frenzies on the herrings and sardines: gannets dropping out of the sky, minke whales coming up through it, and dolphins and porpoises belting around amongst it all. It's an amazing sight." Michael Taylor-Firth, fisherman, Cornwall

SECTION SIX

MONITORING

- **Build on relationships with fishing communities, as well as developing a common language and understanding of species and gear, as a foundation for collaborative action**

In order to collaborate with the fishing industry, it is important to first spend time building relationships and establishing a common language on cetacean species, different gear types and how these are deployed. Feeding back outcomes from industry-implemented monitoring is also important to create a sense of ownership over the process and support fishers in their own decision-making.

Examples of relationship-building projects

A project to test remote electronic monitoring systems on small-scale vessels in the Netherlands initially had limited uptake, but investment in building relationships and being available at the port during out-of-office hours dramatically increased fisher participation.[WP21]

A project led by ZSL and Natural Resources Wales to improve understanding of Angelsharks in Wales discovered after collecting anecdotal data that there were 13 different names for the same species. This was vital information in designing ongoing data collection.[WP2]

- **Work together and use technology to assist self-reporting and validation**

New technologies provide opportunities for streamlining data collection and allowing for data verification, for example through the use of apps, cameras or acoustic devices. The fishing industry needs to be involved in the design of data collection systems both to ensure it is intuitive, but also to agree privacy and data storage rules.

Example of developing a data collection system in collaboration

Together with Aberdeen University, demersal trawl fishermen working off the west coast of Scotland have helped design the data collection system to give the fleet real-time information on bycatch rates and help predict areas and times that can be avoided.[WP14]

Working together can also be facilitated by the use of online platforms such as Wildlabs[3] – a digital hub for sharing conservation-focused software and hardware design. Funding contracts can stipulate that open-source software should be used to speed up innovations and minimise duplication of effort.

[3] www.wildlabs.net

SECTION SIX

MONITORING

2) Bring together and validate monitoring streams into one place (e.g. a digital hub)

- **Improve the identification and our understanding of cetacean bycatch hotspots**

There is a need to develop a better spatial and temporal understanding ('where' and 'when') of cetacean bycatch hotspots, specified by fishing gear, area and seasons. This would allow mitigation actions to be targeted and have the most beneficial impact.

"Without robust evidence of the circumstances in which bycatch occurs, it's hard to defend an argument to change what fishers do or to ask an entire industry to modify its practices." Dr Simon Allen, University of Bristol

- **Bring together all monitoring streams (e.g. observer, strandings, sightings, electronic monitoring and fisher self-reporting) on UK cetacean bycatch and abundance**

Monitoring streams need to be improved and effectively brought together to allow better identification of cetacean bycatch hotspots. This involves linking established monitoring programmes (UK observer and stranding programmes) with emerging methods including: automated electronic monitoring (such as cameras and acoustics); fisher self-reporting schemes; and anecdotal information from interviews.

The linking of data streams will also allow for better validation of different data sets which otherwise might have large undetected errors. For instance, intensive observer programmes (e.g. over 6-month periods) may be used to validate self-reporting by fishermen. Likewise, camera monitoring can be used to establish how much cetacean bycatch falls out the net and remains unseen by observers.

Monitoring streams, with support of regional and international partners, can also help improve our understanding of cetacean abundance and the potential conservation impact of bycatch.

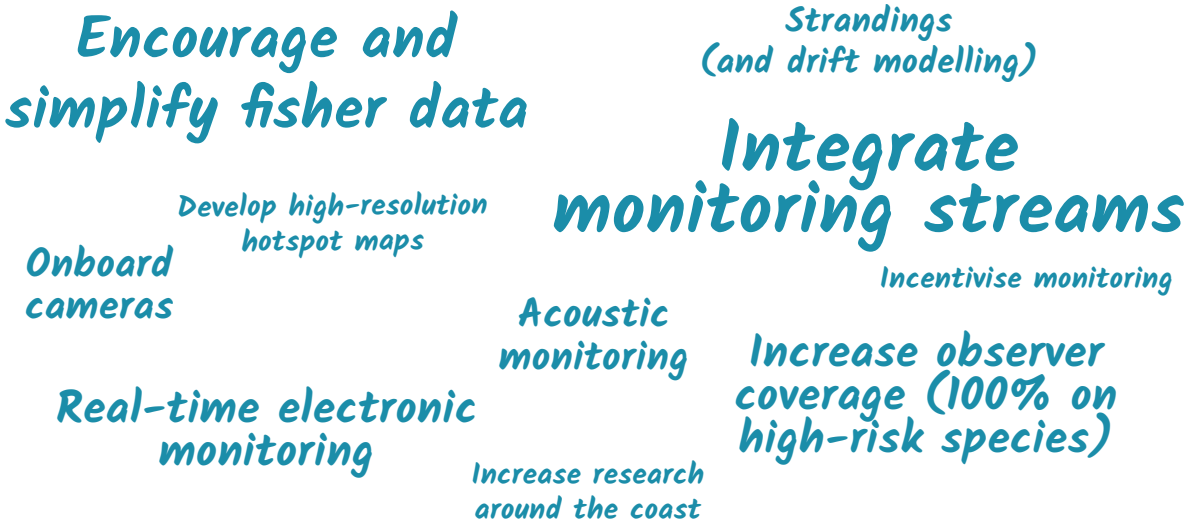
- **Agree clear guidelines and protocols for data collection**

Data must be collected in scientific robust and standardised formats wherever possible, to allow more efficient integration and analysis.

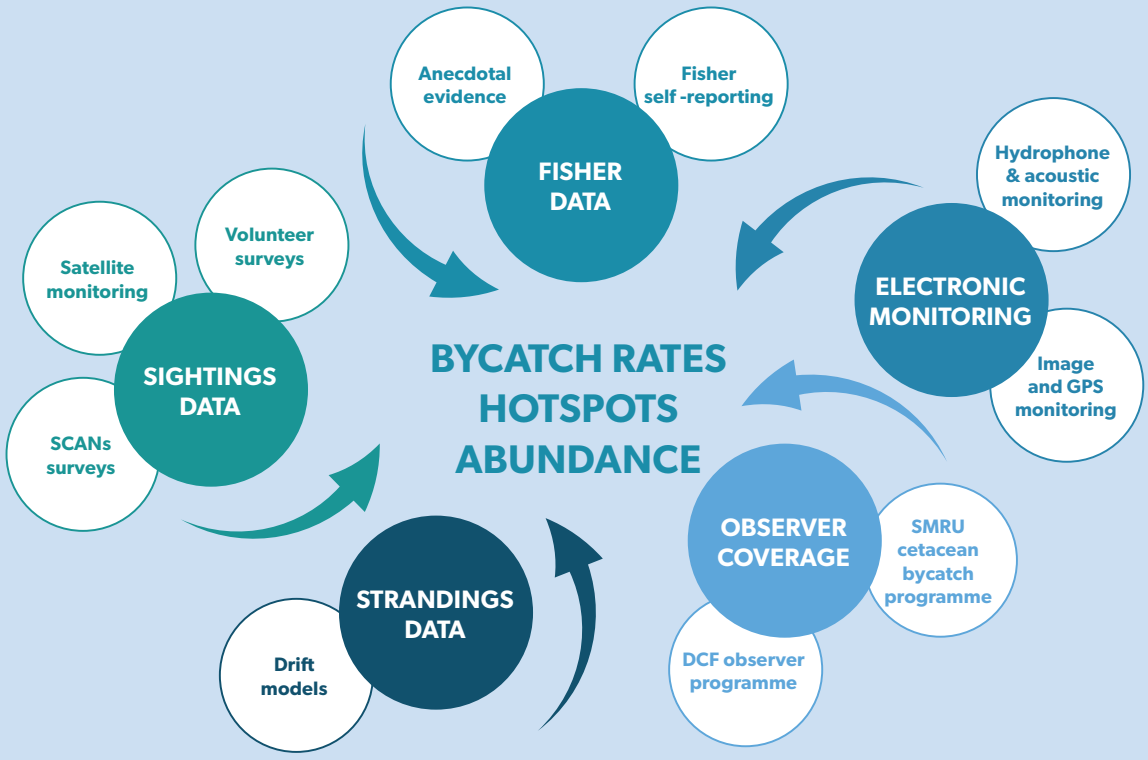
"Monitoring is absolutely key. We need a much better understanding of what's happening at sea, not only for cetaceans but more broadly across fisheries if we are to understand the impacts." Helen McLachlan, Fisheries Programme Manager, WWF

MONITORING

Participants' priorities for cetacean monitoring



Bringing together monitoring streams will allow for more accurate data to better estimate cetacean bycatch rates and identify bycatch hotspots at a finer resolution.



SECTION SIX

MITIGATION

Groups of attendees scrutinised each other's ideas and debated actions to develop recommendations.

1) Develop the mitigation '*tool box*'

- **Share the current range of mitigation options and how these have worked (or not) in trials in a digestible format that facilitates decision-making**

Options for mitigation need to be better communicated and shared through a digital hub in a digestible format for the fishing industry and other stakeholders from a non-scientific background.

Information on mitigation options can be better organised to help end-users identify the most relevant options as well as new innovations. This could be achieved by developing a decision tool based on appropriate indicators such as: practicality; cost; gear type; bycatch concern; and levels of success in different situations. Similar tools have been created for other issues – Gearing Up[4], Seafish Gear Change[5] - and international resources such as the bycatch.org website already exist and can be harnessed or used as a template to build from for the UK context.

2) Local solutions for local challenges

- **Use a regional approach:** *Local challenges – Local ambition – Local decisions*

Set up local cross-disciplinary teams along the lines of the US 'Take Reduction Teams' model (Box), that can design monitoring and mitigation plans that are adapted to the specific gear being used and the particular bycatch problems encountered. These teams are mandated through legislation in the US but could be voluntary in the UK.

US Take Reduction Teams

These multi-stakeholder groups – representing the fishing industry, fishery managers, scientists and conservation organisations – have been established in the US under the Marine Mammal Protection Act (1972). They are responsible for take-reduction plans to prevent depletion and aid recovery of strategic marine mammals including: endangered species, populations in decline and situations where bycatch exceeds Potential Biological Removal (PBR) thresholds.[B]

"Cetacean bycatch is a complex topic that needs significant regional support and input to tackle it. We've discussed the idea of regional groups before and I think that is going to be important to get the right people engaged." Nikki Taylor, JNCC

[4] gearingup.eu
[5] www.seafish.org/article/selective-gear-technology

MITIGATION


Fishermen and scientists discussed mitigation options.

- **Prioritise mitigation in bycatch hotspots, ideally using open-source and low-cost methods**

To make the best use of limited resources, it will be important to prioritise areas and use open-source and low-cost methods that allow for rapid innovation and the greatest reach. A local approach can build collaborative relationships, increase awareness of cetacean bycatch, as well as prioritising areas of known high cetacean bycatch.

"Fishermen are more likely to support mitigation measures where they are proportional and practical." Bally Philp, fisherman, Scotland

3) Build an evidence base

- **Trial mitigation methods at the local level**

One size doesn't fit all and any mitigation should be trialled to see how it performs in situ. This will allow for tailored approaches, including modification or combination of options to deliver the most effective and practical outcomes. Regulations and policies need to facilitate this.

"Current legislation can hinder gear development, as fishermen can be penalised for trialling more selective gear if it is not specified in the technical gear regulations. This can restrict fishermen from testing and operating innovative gear modifications." Richard Caslake, Cornish Sardine Management Association

- **Ensure trials are scientifically robust**

The effectiveness of mitigation measures needs to be demonstrated using scientifically robust methods and project design, ideally feeding into the proposed digital hub. Intuitive ideas that may seem obvious still need to be evaluated for their effectiveness at the local level.

Example of the importance of testing 'intuitive' ideas

Stiffened ropes used off the west coast of the US to reduce entanglement of North Atlantic right whales in pot lines were found to reduce bycatch encounters but also caused more severe injuries to those that were caught.[WP26]

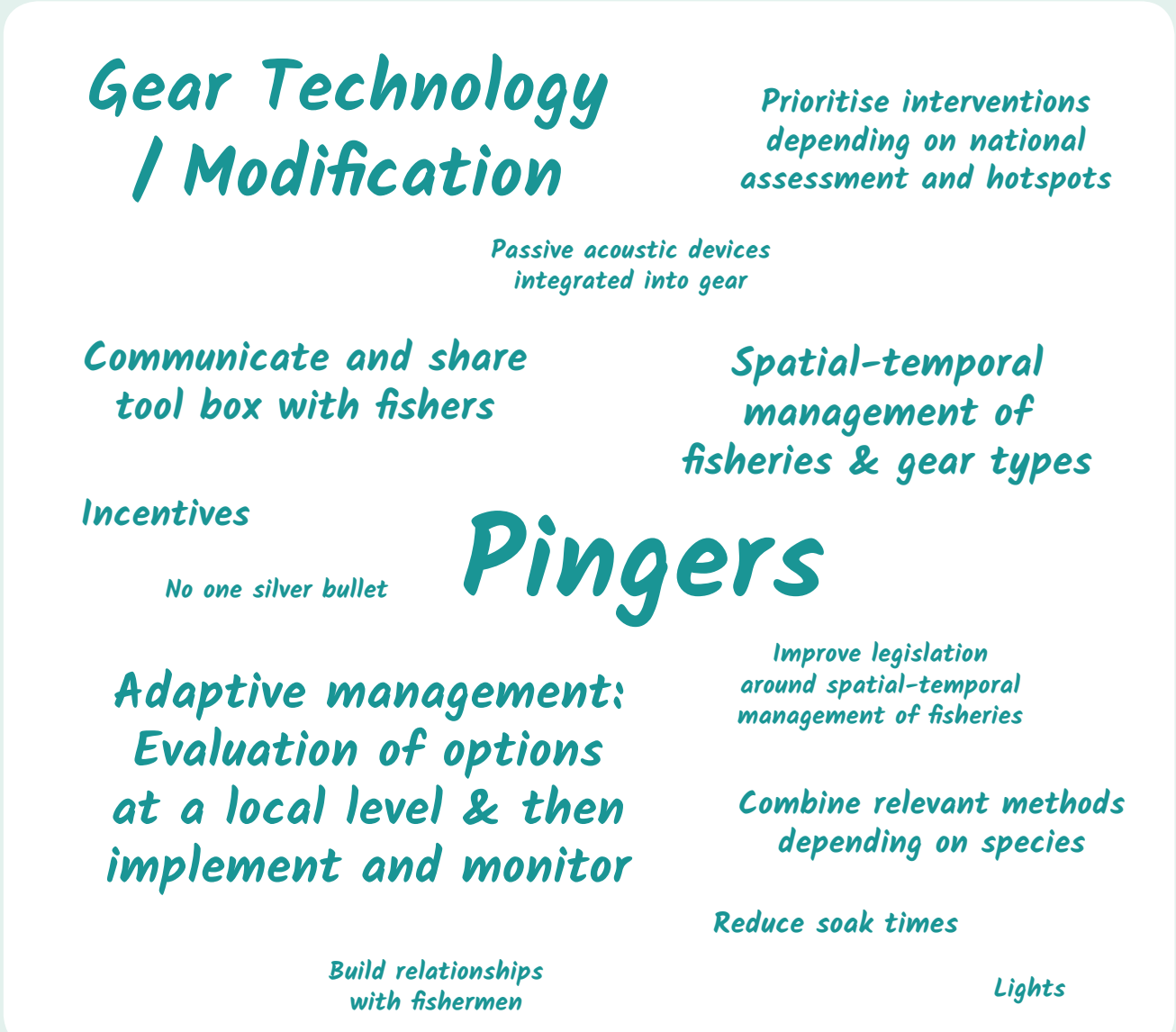
SECTION SIX

MITIGATION

- **Bring the results of mitigation trials into one place**

Build the evidence base for methods that are effective in different situations within the UK context and ensure this is shared; for example, through a digital hub or decision-tool. Impacts on fishermen and communities also need to be captured as well as the implication for wider fisheries management; to avoid solving one problem, only to increase an impact or cause another problem elsewhere.

Word Cloud on Participants' priorities for bycatch mitigation



SECTION SEVEN

NEXT STEPS

Building on the recommendations of this workshop, Defra and Cefas have identified the following time-bound next steps in order to maintain momentum and collaborate with stakeholders to take action.

1) Local solutions to local challenges: Commencing summer 2019

- Initially focusing on Cornwall, Cefas and Defra will develop and expand a programme of engagement and collaboration with the Cornish fishing fleet ***(involve the fishing industry)***. Building relationships based on trust and respect, anecdotal information will be gathered on possible cetacean bycatch hotspots and/or at-risk fisheries around the Cornish peninsula in order to support targeted action.
- Establish a regional focus group in order to provide a platform for collaboration across Cornwall, driving forward work necessary to ***build the evidence base*** and developing practical and pragmatic conservation and management strategies for cetacean bycatch in Celtic Sea commercial fisheries. The group met for the first time in March 2019 as the Cornish Regional Focus Group, and includes fishermen, Cefas, Defra, Cornwall Wildlife Trust (CWT), Marine Management Organisation (MMO), Cornwall Inshore Fisheries and Conservation Authority (CIFCA) and other interested stakeholders.

2) Integrate and balance monitoring and mitigation: Commencing autumn 2019

- A current industry-led cetacean bycatch monitoring trial involves six vessels along the south Cornish coast who are using a novel reporting app that allows them to electronically record levels of cetacean bycatch which are then reported to Cefas. This will be expanded to a regional, self-reporting programme around the Cornish peninsula to increase coverage and improve our understanding of bycatch levels in different areas. This will involve using the *cCatch* Smartphone app to self-report, Vessel Monitoring Systems (VMS) or tracking apps to record location, tagging dead bycatch and electronic monitoring for verification ***(Design and conduct monitoring in collaboration with the fishing industry)***.
- Scientifically robust bycatch ***mitigation trials*** will be undertaken in appropriate areas, alongside monitoring. This will involve more than one location around the Cornish peninsula and will use different types of mitigation to evaluate and compare effectiveness.

SECTION SEVEN

3) Prioritise mitigation in bycatch hotspots: Commencing autumn 2019

- Defra will work with stakeholders to implement conservation and management strategies developed by the Cornish Regional Focus Group (working within the constraints of the political landscape and resource availability) and disseminate our results to EU and non-EU partners.
- If this approach is successful in Cornwall, it will be used as a model for other bycatch hotspots in the UK.

4) Bring together and validate all UK monitoring data streams: Commence in the next 6 months

- We already have a National Bycatch Focus Group, which provides an oversight and steering role to this work, bringing together outputs from the Regional Focus Groups and feeding advice to policy. This group will identify data streams and sources to collate for a ***digital hub***, making use of existing online platforms and signposting to additional sources of data and information relevant to cetacean bycatch.
- Using published outputs of bycatch mitigation trials, we will draw on existing resources to develop a ***mitigation 'tool box'*** to clearly and concisely provide information on mitigation options for particular species, regions and/or fisheries in the UK. Alongside this, we will develop a tool to support managers in taking decisions (e.g. decision tree).
- While the digital hub and 'tool box' will be hosted by Cefas, we will make sure it is publicly available.

5) Measuring success: Ongoing

- Independent members of the National Bycatch Focus Group will objectively review and evaluate whether the workshop's conclusions are being progressed and provide strategic input into the initiative. Stakeholder meetings will be used to gauge progress, identify lessons learnt, and identify next steps to ensure continued progress.

Defra's policy questions guided participants' discussions on recommendations, leading to next steps.

SECTION EIGHT

STAY IN TOUCH

As indicated in the next steps, Defra is taking forward the recommendations of this workshop to develop a more coordinated and collaborative approach to tackling bycatch in the UK.

Stakeholder engagement will therefore remain absolutely central to this initiative's efforts to reduce the impact of fishing activity on cetaceans around the UK. Cefas, Defra and ZSL invite proactive input from anyone with expertise or experience on this issue, to contribute and disseminate information about the project and workshop. Stay in touch, collaborate and read about developments with the ***Reducing Cetacean Bycatch*** project:

- **Website:** www.cefas.co.uk/cetacean-bycatch-workshop/
- **Twitter:** #HaulingUpSolutions
- **Project lead:** stuart.hetherington@cefas.co.uk

"I know there is no easy solution to tackling this issue, but I also know that we all have the same goal – nobody wants to see dolphins and porpoises being killed in our fisheries. We must all work together if we are to make significant progress in bringing down the levels of cetacean bycatch in UK waters. As custodians of the fifth largest marine estate in the world, the UK has a responsibility to protect our valuable, fragile environment and the animals that live there."

Robert Goodwill MP, Fisheries Minister

SECTION EIGHT

GLOSSARY

Acoustic deterrent device (ADD): A device that is attached to fishing nets which emits noises to deter cetaceans

Bycatch: Unintended capture of a non-target species; or the proportion of a commercial fishing catch that consists of marine animals caught unintentionally.

Cetaceans: Whales, dolphins, porpoises

Depredation: Marine mammals that actively seek out fishing gear to feed on bait or target catch

Gear: Fishing equipment

Gill nets: often used as a general term referring to gill nets, trammel nets, wreck nets and tangle nets

Necropsy: Post-mortem examination of animals

Mitigation: techniques or methods that fishers or fishery managers can use to reduce catch of non-target species

Non-target species: Species not specifically targeted as a component of the catch; may be incidentally captured as part of the overall catch

Pinger: An acoustic deterrent device

Static gear: Fishing gear set at a particular location, with or without bait and left for a period of time for finfish or shellfish to get caught in or on

SWOT: Strengths, Weaknesses, Opportunities and Threats analysis

Target species: Those species primarily sought by fishermen in a particular fishery

Towed gear: Fishing gear that is towed through the water, either on or off the seabed, to catch the target species in a net or dredge

ANNEX

REFERENCES

PUBLICATIONS

Defra (2010) Charting Progress 2: The State of the UK Seas. Prepared by the UK Marine Monitoring and Assessment Strategy (UKMMAS) community.

FAO (2018) Report of the Expert Workshop on Means and Methods for Reducing Marine Mammal Mortality in Fishing and Aquaculture Operations, Rome, 20-23 March 2018. FAO Fisheries and Aquaculture Report No. 1231. Rome, Italy.

Rochas-Bracho et al. (2019) A field effort to capture critically endangered vaquitas *(Phocoena sinus)* for protection from entanglement in illegal gillnets. ESR 38: 11-27.

WORKSHOP PRESENTATIONS (WP)

WP1. Allen, S (2019) Dynamics of dolphin-trawler interactions to inform bycatch mitigation

WP2. Barker, J (2019) New approaches of working alongside fishers to monitor the Critically Endangered Angelshark

WP3. Bell, C (2019) Cetacean bycatch workshop: introduction and key policy questions

WP4. Caslake, G (2019) Challenging fishing convention

WP5. Cubaynes, H (2019) Whales from space: studying whales using satellite imagery

WP6. Davies, D (2019) Monitoring cetacean bycatch using apps

WP7. Deaville, R (2019) Monitoring bycatch through strandings investigation

WP8. Elson, J (2019) The English commercial catch sampling programme

WP9. Hetherington, S (2019) Cetacean Bycatch Workshop: New ways to better monitor and reduce cetacean bycatch around the UK

WP10. Hnizdo, F (2019) Technology innovation

WP11. Hood, A (2019) Working for a common vision

WP12. Kingston, A (2019) What does bycatch mean and what factors influence bycatch rates?

WP13. Laabs, N & Watson, D (2019) Advances in mitigation – light

WP14. Marshall, T (2019a) Scientific bycatch reduction for the West coast of Scotland fisheries using real-time reporting: a work in progress

WP15. Marshall, T (2019b) Mitigation: Space and time

WP16. MacLennan, E (2019) Entanglement monitoring

WP17. Philp, B (2019) A fisher's eye view of cetacean bycatch

WP18. Porter, L (2019) Passive acoustic monitoring

WP19. Ridoux, V (2019) What drift modelling can and cannot tell us about cetacean bycatch in fisheries

WP20. Rojas-Bracho, L (2019) What does bycatch mean: black markets in China, bycatch and vaquita's plight

WP21. Simiemsma, M (2019) Remote electronic monitoring: Monitoring incidental bycatch of harbour porpoises in NL commercial bottom-set gillnet fisheries 2012 – 2017

WP22. Tregenza, N (2019) Behaviour of porpoises and dolphins around nets

WP23. Verfuss, U (2019) Autonomous underwater vehicles as a tool to detect and monitor marine animals

WP24. Werner, T (2019a) Mitigating marine mammal bycatch in commercial fisheries and aquaculture

WP25. Werner, T (2019b) Using sound as a bycatch prevention technique for marine mammals

WP26. Werner, T (2019c) Evidence-based approach to reducing marine mammal bycatch through gear modifications

WP27. Werner, T (2019d) Electromagnetic deterrents – option for marine mammals?

Note: Presenters listed alphabetically.

ANNEX

WEBSITES

A. GearingUp: gearingup.eu

B. NOAA website: www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-take-reduction-plans-and-teams

C. Offshore windfarms' use of acoustics: www.offshorewind.biz/2017/12/15/using-acoustic-deterrent-devices-protects-minke-whales-study-says/

D. SCANS 3 survey: synergy.st-andrews.ac.uk/scans3/

E. Seafish Gear Change: www.seafish.org/article/selective-gear-technology

F. Wildlabs: www.wildlabs.net

HAULING UP SOLUTIONS