Marine mammals management toolkit

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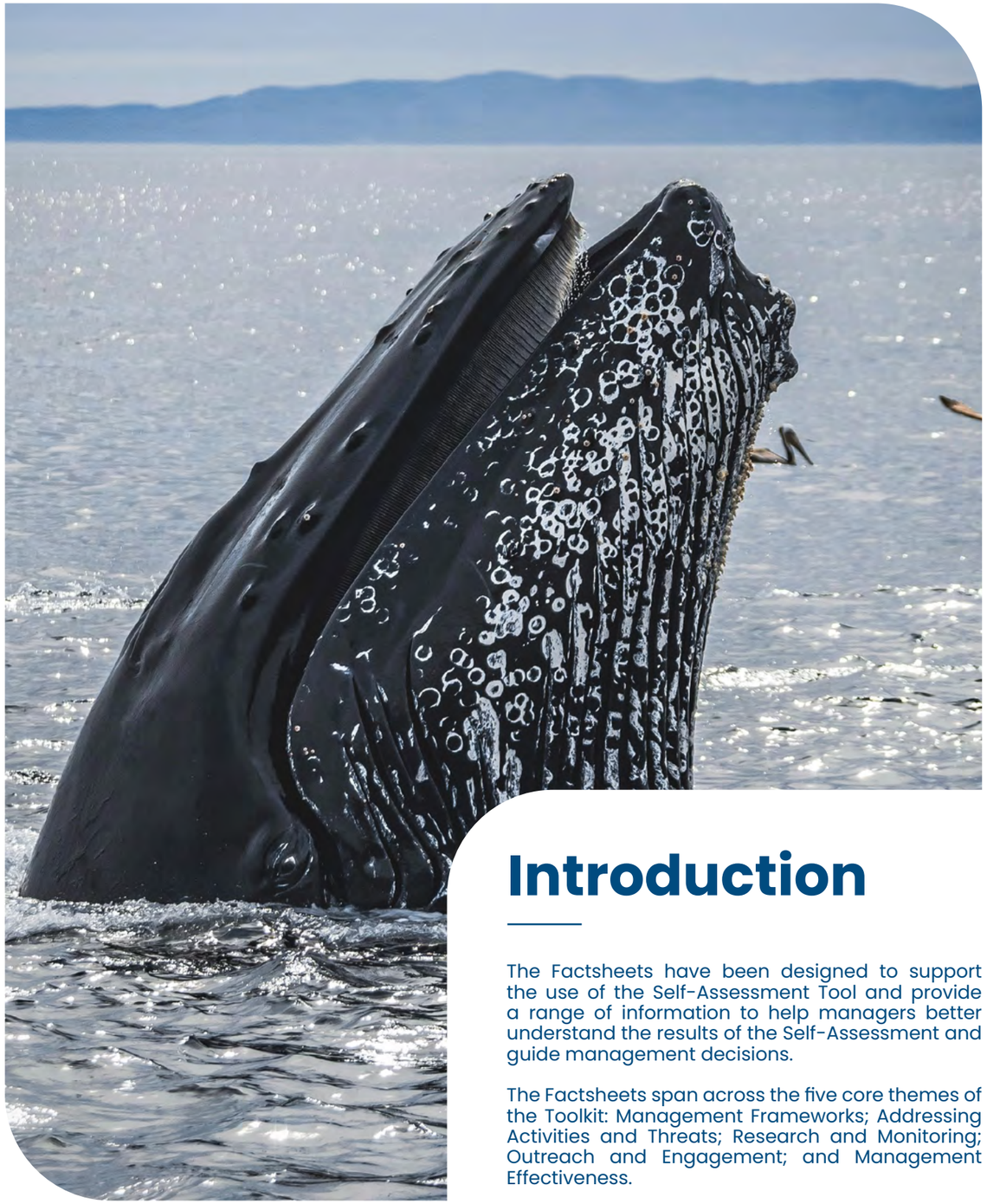
The Factsheets: guiding management decisions

Ocean Governance

This project is funded by the European Union



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Introduction

The Factsheets have been designed to support the use of the Self-Assessment Tool and provide a range of information to help managers better understand the results of the Self-Assessment and guide management decisions.

The Factsheets span across the five core themes of the Toolkit: Management Frameworks; Addressing Activities and Threats; Research and Monitoring; Outreach and Engagement; and Management Effectiveness.

Each factsheet has been meticulously designed to provide concise and valuable information that contextualises examples of common barriers, and guidance on possible management solutions while signposting to the latest available resources and case studies.

You can access the online versions of the factsheets here as well as the Self-Assessment Tool and other components of the Toolkit at www.marine-mammals.info

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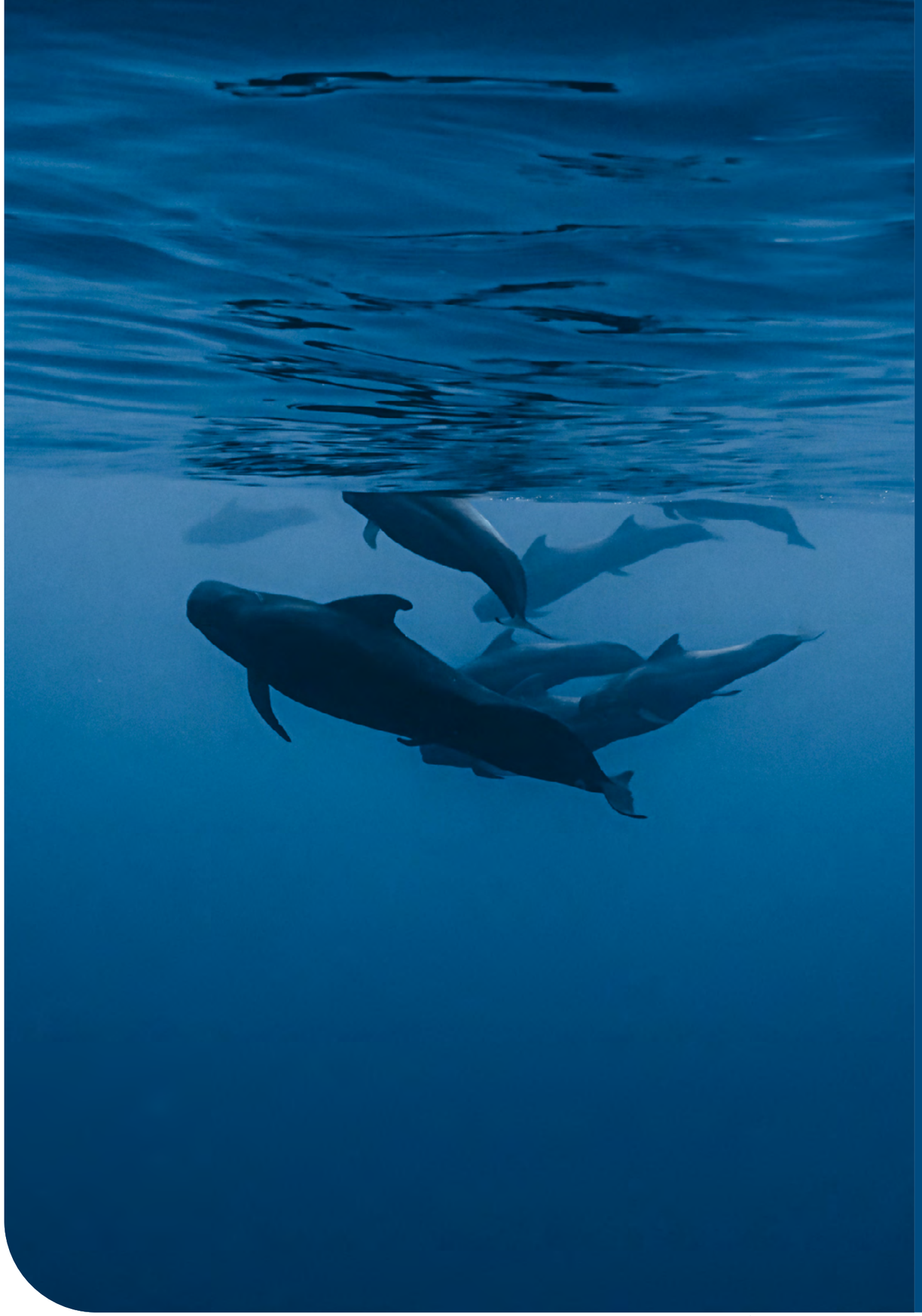

Management framework

MPA management with respect to marine mammals

Management framework

Introduction

An MPA Management plan is an overarching plan through which all, or components of, the management of the MPA are described. The main plan may not contain all of the strategies and regulations. In this case, it should be accompanied by specific management plans and policy documents relating to specific aspects of marine park management or to specific species of concern.

The goals of the MPA should be explicitly outlined, ideally under the SMART (Specific, Measurable, Achievable, Realistic and Time-bound) framework, where feasible, as should more specific objectives [2]. The objectives within the MPA management plan should, if not specifically naming marine mammal conservation as an aim, have aims that will encompass marine mammal protection.

Marine mammal management within a management plan

Marine mammal species, due to their unique biology and life histories, invariably pose unique challenges, and require particular management strategies to deal with such impacts as ship strike, underwater noise, whale- and dolphin-watching tourism and bycatch including entanglement in fishing gear [3].

Furthermore, compared to a large proportion of other marine organisms, marine mammals are slow-growing and slow breeding, meaning that, in the case of many species, the loss of a single individual is significant. Therefore, the separate strategies required to effectively manage marine mammal populations and across life-histories should be explicitly outlined in the management plan, an associated management plan, or operational policies specific to marine mammals [4]. It is important to recognise that collaborative approaches between organisations, countries and administrations may be required in order to develop a network of MPAs that enables the management of mobile species of marine mammals[1]. This is specifically applicable where migratory behaviours result in the movement of individuals between jurisdictions.

Flexibility of the management plan as regards Marine mammals

Marine mammals are inherently difficult to monitor and track. Because of this, and because of the ongoing improvement in research tools and methodologies such as GPS tracking, acoustic tracking, aerial surveys from drones, and data collected from tourist operators and citizen science, new scientific information regarding marine mammal ecology and threats is constantly emerging. Therefore, the MPA management plan should have the capacity to practice adaptive management have flexibility built within the plan to enable the accurate reflection of updated knowledge, approaches and protocols.

This built-in flexibility may also be required to react to unexpected incidents such as animal strandings, or when feeding areas have been damaged or destroyed by a human or natural disaster [4]. Ensuring a reactive and adaptive management plan will contribute to the efficacy of the overall management plan and the MPA.

Species-specific conservation plans

Different marine mammal species diverge greatly in their biology, habitat use, movement and food, for example, meaning that management strategies may need to consider the range of species within the focus areas or consider those that move through management areas.

Secondly, the importance of marine mammal species, due to their function, charismatic 'profile' and status (threatened, vulnerable or endangered, for example), means that management plans for individual marine mammal species should be adapted at some governmental level. Species-specific conservation plans are frequently managed by national agencies, however MPA managers may also create action plans and species-specific policies and assessments [5].

Case study

Conservation Management Plans

Conservation Management Plans (CMPs) are an important conservation initiative of the IWC. They provide a framework for countries within the range of vulnerable cetacean populations (known as range states) to work together, and in collaboration with other relevant stakeholders, to protect and rebuild those populations. The CMP programme is managed by the Standing Working Group on CMPs in accordance with the principles outlined in the CMP work plan. The process for each CMP involves a number of interrelated stages: nomination; development; implementation; monitoring; and review. CMPs have been developed for four vulnerable cetacean populations: the Western North Pacific Gray Whale, the Western South Atlantic Southern Right Whale, the Eastern South Pacific Southern Right Whale, and the Franciscana dolphin (the first CMP for a small cetacean species).
Read more on the IWC website

Resources & references

Additional resources

- *Conservation Management Plans*
- *Cetacean conservation in the world's rivers, lakes, and oceans*
- *Papers from IUCN Marine Mammal Protected Areas Task Force*
- *MPA Directory: Cetacean Habitat MPAs Worldwide*

References

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2. *PDFDownload:UNEP-MAPRAC/SPA,2011.Guidelines for the Establishment and Management of Marine Protected Areas for Cetaceans. By Giuseppe Notarbartolo di Sciara. Ed. ACCOBAMS-RAC/SPA, Tunis. 36pp.*
3. *Great Barrier Reef Marine Park Authority (2007). Operational Policy on Whale and Dolphin Conservation in the Great Barrier Reef Marine Park. GBRMPA, Townsville*
4. *A Vulnerability Assessment for the Great Barrier Reef: Dwarf Minke Whales*

Coordination between agencies with respect to marine mammal conservation

Management framework

Introduction

Marine Protected Areas (MPA) are often designed through the need to achieve goals, whether this is to protect species, conserve biodiversity, manage and restore a certain ecosystem and/or to reduce and prevent detrimental impacts either on a local, national, or international scale. Therefore, management plans can be diverse and vary considerably between MPAs.

Place-based marine mammal conservation has been common practice amongst organisations, governments and within international strategies. However, networks of, and increase connectivity between, MPAs are becoming more popular. This is following the recognition that marine mammals live and range at a variety of scales and management actions should reflect that [1].

Therefore, managers should aim to afford adequate protection to species either during migration, or wide-ranging activities, or a marine mammal population's habitat that are critical for its survival at various life stages (such as breeding and foraging) [1].

These wide-ranging behaviours often result in movement across and between jurisdictional boundaries thus requiring coordination between agencies to instigate adequate protection whether this is the establishment of multiple MPAs, large, encompassing MPAs, or limiting detrimental activities on a seasonal or locational basis in areas between MPAs. As such, a number of government agencies may regulate the activities that can affect marine mammals within an MPA.

Beyond life history behaviours and population movement, marine mammal species can be affected by a range of acute and chronic impacts that arise from a range of activities, including fisheries, tourism, and shipping, as well as land-based activities that cause industrial discharge, and terrestrial run-off. Despite some activities causing potential local impacts, others can have far-reaching influence that may extrude beyond an MPA's boundaries and/or between jurisdictions. This adds further complexity for managers and requires multi-lateral collaboration.

There may also be social, cultural and traditional drivers behind the necessity to manage MPAs under a collaborative framework. For example, many traditions and cultures place significant value on the exploitation of marine mammals and thus, where such human populations maybe affected by the establishment of an MPA, mangers should ensure that stakeholders are consistently consulted, traditional knowledge convened, and incorporated into the planning, set up and management of the MPA and marine mammal populations.

Issues arising from the involvement of multiple agencies

Various governmental agencies that operate between sectors and across different environments, for example fisheries, tourism, conservation, shipping, ports, mineral exploration, and agriculture, as well as across scales including local and national governments, may contain a variety of viewpoints, be subject to substantial political lobbying or be driven by opposing commitments. Indeed, conflict and/or lack of cooperation between environmental and fisheries management agencies, for example, or between countries, is a common factor that can inhibit the efficacy of management for marine mammals and respective MPAs [2]. Other drivers further add to the complexity of marine mammal management such as the socio-economic conditions of communities and countries that interact with marine mammal populations. The flow of adequate information and resources maybe impacted or restricted in low-income countries or conservation needs may conflict with the interests of stakeholders, especially concerning livelihoods and food security [1].

Formal agreements and cooperation between agencies

Multi-use MPAs are, by definition, designed to serve sustainable use and environmental protection, and relevant agencies should aim to collaborate from the establishment phase, advocating for transparent process and stakeholder engagement. These conditions also form the basis for establishing networks of MPAs or when aiming to increase connectivity between key life stage habitats for marine mammal populations across jurisdictional settings. Formal arrangements can then allow for coordination between agencies for ongoing and adaptive management.

Formal data sharing agreements either across, or between government(s), or between specific agencies, can maximise the value of data and prevent duplication. This ensures that, where resources are scarce, are used more efficiently [3] and provides access to the diverse types of information (where they exist) that are required to manage an MPA and marine mammal populations.

The protection of marine mammals should be formalised in legislation and regulations with respect to the activities under the remit of other agencies, as well as under international commitments, such as the EPBC Act in Australia [4] or the declaration of Exclusive Economic Zones (EEZ) as marine mammal sanctuaries [5].

Case study

Tarium Niryutait – Canada's First Arctic Marine Protected Area: Convening Traditional Knowledge to build Northern Conservation and Enhanced Local Governance

The Tarium Niryutait MPA, is an MPA in the Canadian Arctic. This federally protected MPA was designed to support a sustainable beluga whale harvest by local artisanal Inuvialuit fishers and has community support at the heart of the decision making process. The legislation successfully addresses both land rights and the environment: the signing of the Inuvialuit Final Agreement in 1984, between the Inuvialuit and the government of Canada (the first comprehensive settled land claim) established a new paradigm of cooperative management for fish and mammal resources. The MPA is supported by the local community as sustainable harvesting of whales for both economic and cultural reasons is permitted. Local knowledge and effective stakeholder participation provided local fishers with bottom up involvement, while state legislation – the top down aspect – creates long term resilience. While this MPA is still in the development stage, it has a strong governance structure at national, regional, and local levels that allows for delivery, management and monitoring plans, backed by community involvement at all stages.

Tarium Niryutait Marine Protected Area (TN MPA)
Adopted from Soland et al. 2014 [6]

Resources & references

Additional resources

- *European Environment Agency: Marine environmental pressures.*
- *IUCN Guidelines for Marine Protected Areas*
- *EU4Oceanobs – Share Ocean Data and Information*
- *Environment Protection and Biodiversity Conservation Act 1999, Australia – Cetacean legislation*

References

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2. *Kelleher, G. (1999). Guidelines for Marine Protected Areas. IUCN, Gland, Switzerland and Cambridge, UK. xxiv +107pp*
3. *EU4Oceanobs – Share Ocean Data and Information*
4. *Cetaceans: Legislation*
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Zoning and permitting

Management framework

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Introduction

Marine environments are typically subject to multiple uses including commercial fishing, recreation, tourism, and transport. The activities allowed or undertaken are often defined by a marine management area's ordinance or tied to goals. MPAs that are multi-use allow defined activities to take place through the use of zoning.

MPAs may host an array of habitats, some of which may be important to marine mammal species of interest, and/or may not extend over large areas. Therefore, MPA managers should aim to provide a balance between conservation interests (only some of which may involve marine mammals) and area use. This could involve control over what activities should be permitted, where they should be allowed to occur, the extent of each activity, and the manner in which it should be conducted, in order to adhere to the goals of the MPA.

What is zoning?

Zoning is a key management tool for multi-use MPAs. Zoning helps to manage and protect the social, cultural, traditional and/or ecological values of the MPA [1], setting aside areas for particular activities such as key habitats, aggregation or breeding sites, education, recreation, or tourism [2]. Defining zones throughout the management area where particular activities can take place facilitates the separation of conflicting activities [1].

Each type of zone in an MPA will have differing ordinance for where and when activities are permitted [1]. An MPA zoning plan will be driven by the overall goals of the MPA, the value of other uses, and the influence of users of the MPA. With respect to marine mammals, a zoning plan should provide protection to marine mammals from detrimental activities in areas of the MPA crucial to life history (critical areas), either permanently or on a seasonal basis if the species of interest are migratory.

Creating a zoning plan that protects cetaceans

There are many strategies for creating an MPA system of zones, and these will depend on the goals of the MPA. With respect to marine mammals, all available ecological and behavioural information should be assembled (and where possible, obtained if needed) in order to map the critical habitat of the target marine mammal species [3]. Secondly, spatial and temporal data on actual and potential human activities, as well as identified impacts, should also be integrated and mapped. Areas that are deemed critical or particularly sensitive should be given stricter levels of protection with fewer or no activities permitted [4].

A form of formal or informal Environmental Impact Assessment (EIA) should take place before implementing an MPA zoning plan, by considering potential impacts of different activities on marine mammals and assessing the compatibility or otherwise of each. A transparent communicative process with all MPA stakeholders should also form a critical component of the planning phase. This will limit future conflict, protect values and increase compliance. This information will dictate or influence the design of zoning plan in the MPA [5].

Permits and impact assessment

A system of permits that integrates the impacts of activities allows MPA managers to control and monitor human activities within the MPA, as well as setting out the conditions under which an activity can take place, either within the MPA or particular zones. Permits may be supported by detailed regulations, such as quotas, gear types, or vessel speed and may require supporting documentation such as an EIA.

An EIA also should be compulsory prior to the any new or expanding activity likely to pose a risk to marine mammals, using best-practice EIA methods. This should apply to on-water (eg. Expansion of whale- or dolphin-watching activities) or extractive (eg. commercial fishing) activities, or development of on-water (e.g. pontoons) or coastal developments [6].

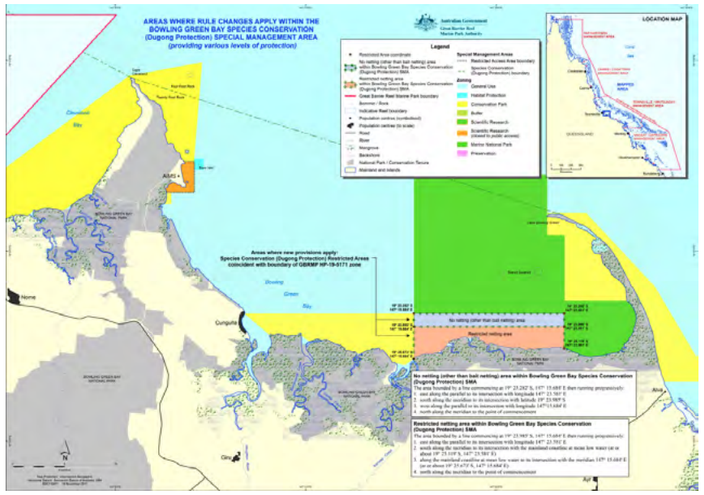
Case study

Great Barrier Reef zoning plan (Australia)

Case study – Great Barrier Reef zoning plan (Australia)
The Great Barrier Reef Marine Park Authority (GBRMPA) implemented a Zoning Plan in 2004, after an exercise involving bioregion mapping, systematic conservation planning, consideration of the distribution and intensity of human uses within the Marine Park, and extensive public consultation.

Zones cover the entire marine park (343,966 km2), and denoting what activities are allowed, which are prohibited, and which activities require a permit. These include (in rough order of levels of protection General Use (open to commercial and recreational fishing including trawling), Habitat Protection, Conservation Park, Buffer, Scientific Research Marine National Park and Preservation zones, in order of levels of protection through the types of activities that are permitted [1].

In addition, specific Dugong Protection Areas, provide increased protection from specific threats such as boat-strike and net-fisheries.
Read more about Dugong Protection Areas



Resources & references

Additional resources

- *Vertical zoning of MPAs: When it is appropriate, when it is not, and how science is changing our understanding*
- *Incorporating Conservation Zone Effectiveness for Protecting Biodiversity in Marine Planning*
- *Concept of zoning management in protected areas*

References

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5. *EIA Topic: Marine Mammals*
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Good Practices

- *Licensing of scientific research activities in Bermuda's Exclusive Economic Zone (EEZ)*

Planned responses and contingency plans for major incidents

Management framework

Introduction

Major incidents are here defined as serious human-caused incidents that are unpredictable and episodic, and can damage or disturb marine biota, including marine mammals. These include oil spills, ship groundings, the sinking of vessels, and outbreaks of invasive species, all of which may impact marine mammals.

Potential impacts of major incidents on marine mammals

Oil spills are known to pose significant risks to sea otters and various species of pinniped that rely on fur for insulation and bioaccumulation. Ingestion of oil poses a risk to cetaceans that occupy nearshore waters such as coastal dolphins, while all marine mammal species might experience behavioural disturbance from the slick or by clean-up operations [1].

Ship groundings may directly damage the benthos and suspend sediment in the water column and may impact seagrass beds [2]. This is particularly relevant for dugong and manatee, which rely on seagrass beds for feeding. Ship groundings, as well as sunken vessels, may also result in the leakage of fuel oil [3].

Invasive species outbreaks have the potential to cause cascading effects to ecosystems, and potentially affect cetaceans such as dolphins [4].

Prevention and Surveillance

While the risk of major incidents cannot be completely eliminated by MPA management, strategies such as carefully locating shipping channels, enforcing the use of shipping channels (through AIS tracking), pilotage regulations and training, and rules for dealing with ballast water [5]. Early detection of invasive species within an MPA may involve targeted surveys and cooperation with community groups or tourist operators [6].

Responses to Major Incidents

The capacity to deal with major oil spills, ship groundings or sunken vessels is often within national plans, rather than an MPA management plan. However, MPA management, as part of an effective response, should work closely with other relevant government agencies by providing logistical and organisational support, and providing valuable local knowledge regarding local infrastructure and personnel, and details of natural resources and their vulnerability. For example, in the case of an oil spill in the Great Barrier Reef, Maritime Safely Queensland will lead the response with the cooperation of GBRMPA and other agencies. MPA management in this case provides important local information and can coordinate follow-up monitoring [7].

Further, within a national or regional plan to respond to major incidents, or within an MPA plan, the specific responsibilities of and coordination between MPA management and other agencies should be explicitly stated to allow the most effective, timely response. The plan should allow for rapid permitting procedures within the park to allow a fast and appropriate response to the incident, including for the rescue and treatment of affected marine mammals.

Resources & references

Additional resources

- *NOAA Issues Guidelines for Arctic Marine Mammal Disasters*
- *Arctic Marine Mammal Disaster Response Guidelines*
- *NOAA – Reducing Impacts to Cetaceans during Disasters by Improving Response Activities*
- *IFAW Disaster Response*
- *World Organisation for Animal Health – Emergency Preparedness*
- *Action Plan for Australian Cetaceans*

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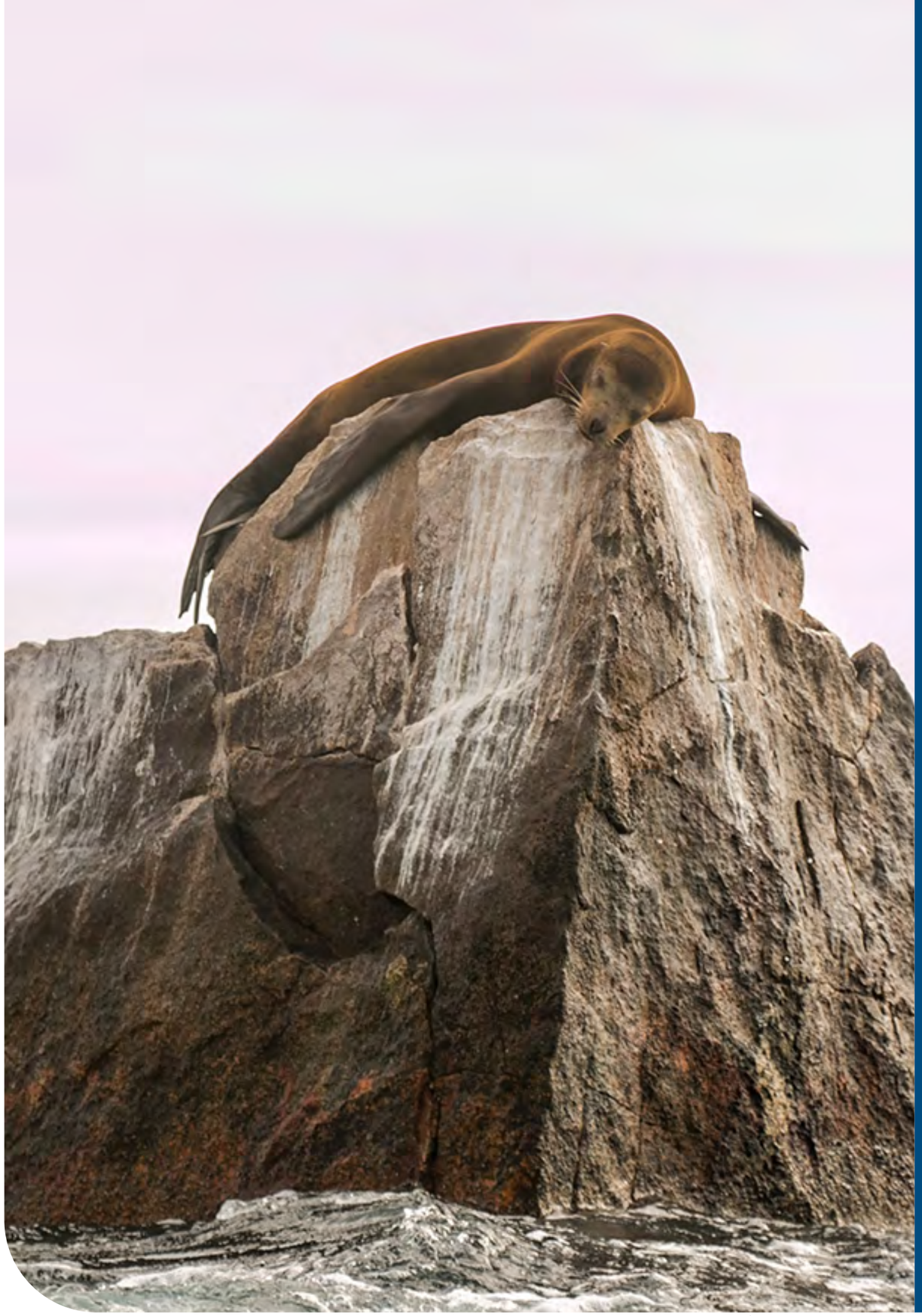
5. *Managing activities and use: Shipping*
6. *Marine Alien Invasive Species Strategy for the Medpan Network*
7. *Shen Neng 1 Incident Response: Independent Review of the Response to the Shen Neng 1 Grounding and Associated Pollution Response*



Addressing Activities and Threats

Whale and dolphin watching

Addressing the activities and threats

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Introduction

Marine mammal watching often referred to as whale watching, includes tours by boar, by air or from land to see, swim with, and/or listen to [1]. Generating income, these activities enable paying tourists to observe cetaceans, beyond whales, dolphins and porpoises, including manatees, dugongs, pinnipeds and otters, for example, in their natural habitat. These activities provide tourism income and associated economic activity as well as employment for many communities around the world [2].

Well-managed marine mammal watching operations can lead to secondary benefits; local communities can foster pride and sense of stewardship for the marine mammals that benefit their economy, and the educational benefits both locally and in the broader sense are well-documented [3]. High-profile and responsible operations can raise the value of cetaceans in their natural environment with research indicating that such tourism-based activities have the capacity to increase the environmental awareness and conservation intentions of participants [4-6]. Finally, operators are also more likely to locate injured or entangled cetaceans while collaborating in research to obtain valuable data for cetacean [3].

Potential impacts of whale watching?

Most impacts from whale watching activities relate to disturbances to cetacean behaviour. Vessels may trigger predator avoidance responses such as deeper and more frequent dives, or rapid changes in direction. The strength of this response, and thus the behavioural impacts, tend to increase with vessel proximity and greater boat abundance. Cumulative effects, with subsequent energetic costs, may occur when specific individuals or group of cetaceans are consistently exposed to watching activities. For example, resident whales or dolphins that are repeatedly interrupted during feeding or resting may be impacted more greatly over time than migratory individuals.

Although watching activities concerning cetaceans have, on a few occasions, been linked to a population disturbance [7] or a movement of animals away from the area targeted for tourism, dolphins have been more noted for their longer-term behavioural changes, such as avoidance of vessels and swimmers, and population decreases.

Whale and dolphin watching, therefore, must be carefully managed in order to maximise the benefits of education, public awareness, and conservation, while minimising the impacts on species and populations, particularly given that some species are threatened or vulnerable [8].

Whale and dolphin watching management strategies

Impact minimisation mainly involves strategies to reduce stress or disturbance to the animals and reduce the likelihood of other adverse behavioural changes. Strategies will vary depending on the species concerned but should be based on the best available science.

Stress and disturbances can be limited through the application of regulations concerning approaching individuals or populations of cetaceans (e.g. direction of approach, vessel speed, proximity to cetaceans, numbers of vessels allowed in the vicinity of an 'encounter' etc.). In addition, physical contact with cetaceans and the use of scuba should be prohibited, and loud noise should be discouraged.

Other adverse behavioural effects can be reduced by bans on feeding, and cumulative effects on individuals, groups or populations can be reduced through limits on the number of operator licences and frequency and/or duration of trips whilst also noting seasonal changes in populations and individual life histories. For example, this could include prohibiting watching activities during breeding season.

Regulations or voluntary Guidelines?

Given that tourists often wish to have a 'close encounter', pressure may be felt by operators to bend or break the guidelines, especially where market competition is high. Therefore, regulations with penalties are preferable to guidelines. National or State government laws or regulations may also provide added management power. Enforcement of regulations, particularly in offshore areas, can be enhanced by the presence of observers and trained (and importantly, empowered) naturalists on board, and the use of vessel tracking systems.

Scientific research

Many cetacean watching operations provide an opportunity to collect valuable data on individuals, groups and/or populations through the recording of encounters and submission of photographs and videos. This assists research into species distribution and abundance, habitat use through space and time, and many other ecological and conservation questions [3].

Case study

The high-quality whale-watching certification

Created to supervise an expanding tourism activity and guide volunteer operators, the High-Quality Whale-Watching® certification is an ACCOBAMS (Agreement on the Conservation of Cetaceans of the Backs Sea, Mediterranean Sea and contiguous Atlantic area) trademark jointly developed with the Pelagos Sanctuary.
This certification is in line with a naturalist approach. Cetaceans are wild animals moving in a vast environment and their observation during every trip cannot be guaranteed. That is why certified trips do not target exclusively whales and dolphins. Operators will be keen to show you the marine biodiversity in general: marine birds, fish, turtles, etc.
Besides, the certification guarantees a whale and dolphin approach respectful of the code of good conduct for the observation of Mediterranean cetaceans enacted by the Pelagos and ACCOBAMS Agreements.

Moreover, educational information acquired during a training course is provided to you by the certified operator all along the trip. The training course is organised by Souffleurs d'Ecume, in charge of implementing the certification in the French Mediterranean Sea.
Finally, in the framework of responsible ethics certified operators commit to waste sorting on-board their vessels.
Read more on Whale Watching Label website
Read more on Accobams website

Resources & references

Additional resources

- *Overarching Principles and Best Practice Guidelines for Marine mammal Watching in the Wider Caribbean Region (WCR). UNEP-Caribbean Environment Programme & CAR-SPAW-RAC*
- *Web page: IWC Whale watching handbook*
- *International Whaling Commission Strategic Plan (2018-2024)*
- *PDF: A high-quality whale watching certificate in the ACCOBAMS area (Black Sea, Mediterranean Sea and contiguous Atlantic Area)*
- *Whale watching certificates*
- *Specific information on whale and dolphin watching in Australia*
- *CARI'MAM videos on cetacean watching*
- *World Cetacean Alliance – Global best practice guidance for responsible whale and dolphin watching*
- *IWC General Principles for Whale Watching*

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3. *Benefits of Responsible Whale Watching*
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Good practices

- *Whale SENSE: Consumer Choices Matter*
- *High-quality Whale Watching in the Mediterranean*

Noise Management

Addressing the activities and threats

Co-authored by Charlotte R. Findlay, Postdoctoral Research Fellow, Zoophysiology, Department of Biology, Aarhus University

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Introduction

Noise pollution includes any human-created sound that propagates underwater. The primary and most widespread source of underwater noise pollution comes from motorised vessels at sea [1]. Other major sources include seismic exploration (by oil and gas industries), underwater explosions, underwater construction of nearshore and offshore marine installations, (including marine renewable energy projects), naval sonar operations, and acoustic deterrents [1,2]. Noise from human activities may be acute or chronic, varying in frequency, volume, duration, 'rise time' and repetition rate.

Impacts of noise on marine mammals

Marine mammals, and particularly cetaceans, with their reliance on hearing as their principal sense for navigation, detecting predators, communication and/or hunting, can be extremely vulnerable to anthropogenic noise [3,4]. Potential effects from exposure to anthropogenic noise are varied and can include hearing impairment, stress, changes in behaviour, and acoustic 'masking' (obscuring important natural sounds) [5,6,7].

For example, noise pollution can interfere with marine mammal behaviour, and lead to stress [8], difficulty feeding [9], disruption of nursing and resting [10], and masking of communication [11]; while acute, high-intensity sound exposure from military sonar has led to the mass-stranding and subsequent mortality of beaked whales [12]. However, the responses of cetaceans to underwater noise pollution have been shown to vary and likely depend on factors including the noise characteristics, context of exposure, and animals' biology [13].

Regardless, repeated exposure and disturbance due to anthropogenic underwater noise has the potential to affect the energy budgets of marine mammals if they are not able to compensate for these exposures [14], which may culminate in negative impacts to an individuals' vital rates and potential population-level consequences.

Management strategies to minimise the impacts of noise

**Note; many of these management strategies may fall under the partial or full jurisdiction of agencies other than MPA management.*

Given that the impact of noise on marine mammal species varies between species, the type of sound and the location, a variety of strategies may be appropriate in order to reduce these impacts in different MPAs. Furthermore, due to sound travelling much further and faster in water than in air, designated acoustic buffer zones may need to be incorporated outside MPAs to reduce the impacts of noise within the MPA [15].

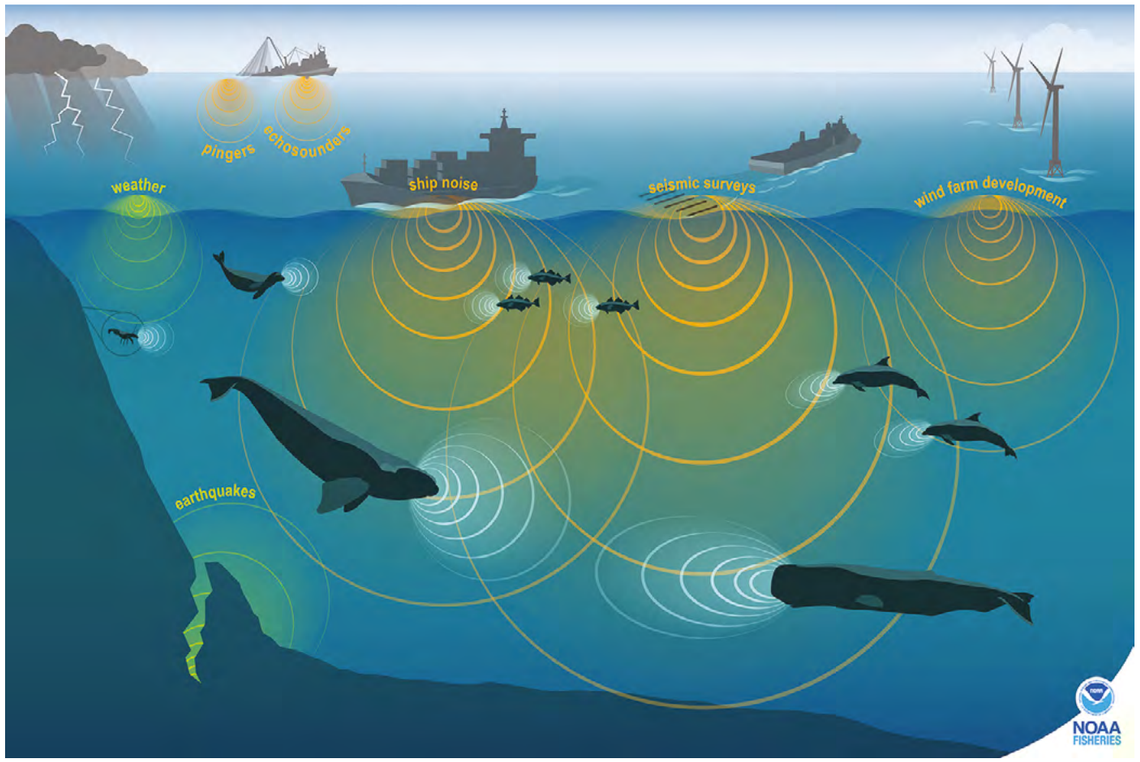
To incorporate management actions to protect marine mammals from underwater noise pollution, legislative responsibility must clearly fall on either MPA management and/or national or regional agencies and be enforceable. Underwater noise limits should also be invoked within the permit process.

Specific management strategies include monitoring (and if possible, maintaining) the status of a species and underwater noise, monitoring the consequences of activities, and incorporating these results into future management plans [16]. Where possible, a precautionary approach to management should be taken with respect to noise pollution alongside the practice of adaptive management in light of new available data and recommendations (the Self-Assessment Tool can aid managers to implement adaptive measures following the assessment of management plans).

Specific management regulations might involve (depending on the species and sources of noise) prohibition of certain sources of noise (such as seismic surveys or military sonar), regulations specific to seasons or important life history locations, maximum acute noise limits for marine construction and maximum allowable limits to chronic ambient noise for fixed sources. For example, current EU Marine Strategy Framework Directive (MSFD guidelines have been introduced for both impulsive and continuous noise sources, with guidelines recommending that, for continuous sources, 20% of habitat (MPA) must be below Level of Biologically Adverse Effect) [17]. An MPA may also develop strategies to reduce the impact of commercial vessel noise on marine mammals (e.g., speed reductions [18]).

Various mitigation technologies may be regulated within a protected area, including the use of alternative reduced noise technologies, and technologies that reduce the noise emitted during conventional shipping or engineering projects. Acoustic Mitigation Devices (AMD) have often been suggested to be deployed to deter cetaceans from specified areas however, research has indicated that such devices can deter marine mammals far greater distances that intended, and in some cases result in temporary or even permanent hearing impairment in some species [19, 20]. Monitoring devices can also be deployed. Acoustic hardware can be used for implementing both passive and active acoustic monitoring and noise monitoring programs. Both fixed and towed hydrophones fall into this category [21].

NOAA Fisheries studies marine animals Sent by using a variety of technologies to record underwater ocean sounds. Marine animals live in a noisy habitat with combined noises from humans, nature, and other species. This conceptual illustration shows images of human, marine animal, and environmental sources of sound and approximately proportional sound waves. Credit: NOAA Fisheries.



Case study

Stellwagen Bank National Marine Sanctuary (SBNMS), USA

An increasingly recognised element of the SBNMS' physical setting is its acoustic environment. The sanctuary is home to many soniferous species, such as whales, that NOAA manages or protects under multiple statutes, notably the ESA and the MMPA. Due to its location, the sanctuary is also a busy place for commerce and is subjected to high levels of sound-producing activities such as commercial vessel traffic.

Within the SBNMS 2023 Stellwagen Bank National Marine Sanctuary Final Management Plan and Environmental Assessment, one of 15 action plans is dedication to noise aiming to "Maintain the role of SBNMS as a sentinel site for passive acoustic monitoring in the Gulf of Maine, and as a test bed for applying these data to both long term monitoring of ecosystems and the design of methods to reduce impacts from human activities". The SBNMS has an established acoustic research programme that has influenced regional, national and international policies for management noise impacts on marine life. Numerous management actions are included within the management

A basic map of the sanctuary and sanctuary region. Map: NOAA

plan, including standardised mitigation metrics to track the influence of vessel traffic noise, real-time glider data reporting to notify the presence of whales within the sanctuary, the use of Right Whale Listening Buoys to determine if noise is lower by slower vessels.

With these management actions, SBNMS implements 6 management strategies;

1. Maintain low frequency monitoring station (Noise Reference Station) to assess changes over time in acoustic contributions from vessels, linked to shifts in calling baleen whales and fish, and compare to regional and national trends;
2. Maintain broadband soundscape monitoring stations (i.e., "SanctSound"), which have collected seasonal data from 2016–18, and continuous data since 2018; assess changes over time in ambient levels and contributions from marine mammals, fish, and vessels as part of regional and national ocean observing arrays;
3. Conduct seasonal passive acoustic and telemetry enabled glider surveys to better understand distribution and behaviour of target sound-producing species in particular areas and time periods
4. Use status and trend information and more detailed knowledge of overlap in biological and anthropogenic sources to monitor indicators of human-induced noise influence;
5. Add an acoustic monitoring station to shipwrecks to deepen understanding of the role of wrecks in supporting sanctuary biodiversity;
6. Identify and initiate additional management actions as necessary.

Within this goal, high-priority strategies include the development of a cooperative marine acoustics research program, and a policy framework for investigating and mitigating noise impacts within SBNMS. Substantial innovative research has been (and continues to be) undertaken into all aspects of underwater noise and its effects on marine mammal species in the sanctuary.

National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries. 2023. Stellwagen Bank National Marine Sanctuary Final Management Plan and Environmental Assessment. Silver Spring, MD.

Read more about the Stellwagen Bank National Marine Sanctuary

International Fund for Animal Welfare (IFAW) Blue Speeds Campaign

Driving Positive Community Engagement and Public Awareness

IFAW has identified a realistic and impactful solution to make the seas safer for marine animals: reduced shipping speeds. The Blue Speeds Campaign was launched in response to the increasing threat posed by fast moving vessels on marine life, particularly whales, dolphins, and porpoises. The Blue Speeds Campaign seeks to set better legislative standards to reduce the negative impact of commercial shipping within European waters, as well as creating widespread awareness among the shipping industry and the general public about the impacts of commercial shipping on marine ecosystems.

The objectives of the Blue Speeds Campaign are to raise awareness of the importance of responsible boating practices to protect marine life; to mobilise and engage the community; to educate boaters and the public about the negative impacts of high-speed vessels on marine ecosystems; and to advocate for implementation of regulations and guidelines to mitigate the adverse effects of fast-moving boats on marine life.

Their strategies included a multi-channel awareness campaign using traditional and digital media channels; forging collaborations with shipping companies, national/international shipowners and port associations, to enable the adoption of Blue Speeds practices; using creative and compelling content to captivate the audience and convey the urgency of the issue; and finally actively advocating for policy changes and stricter regulations and industry standards by collaborating with European and national policymakers, lawmakers and working within the International Maritime Organisation (IMO)..

The lessons learned throughout this campaign are as follows: Collaboration is key – the success of the Blue Speeds Campaign highlights the importance of collaboration and partnerships with diverse stakeholders; Use compelling communication – by using compelling storytelling techniques, IFAW effectively conveyed the urgency of the matter; and finally, by advocating for policy change IFAW was successful in effecting policy change that protect marine life. Such efforts are crucial when creating long-term systemic change.

In conclusion, the IFAW Blue Speeds Campaign exemplifies a successful Community Engagement and Public Awareness (CEPA) initiative that effectively raised awareness about responsible boating practices and their impact on marine ecosystems. Through strategic partnerships, compelling content, community engagement activities, and advocacy efforts, the campaign achieved remarkable outcomes in terms of public awareness, behaviour change, and policy improvements. The campaign serves as an inspiring example for organisations and communities seeking to drive positive change in environmental conservation.

Read more about the IFAW Blue Speeds Campaign

Resources & references

Additional resources

- *Blue Whales and Blue Skies*
- *Impacts of Anthropogenic Sound on Cetaceans*
- *Fact Sheet on Marine Noise*
- *Marine Noise Pollution – Mitigation and the Need for Wider Protection*
- *Quiet(er) marine protected areas*
- *Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities – a tool for decision-makers*
- *IWC Ocean Noise*
- *Best Available Technology (BAT) and Best Environmental Practice (BEP) for Mitigating Three Noise Sources: Shipping, Seismic Airgun Surveys, and Pile Driving*

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Entanglement in fishing gear and other installations

Addressing the activities and threats

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Introduction

The entanglement of marine mammals, typically considered a type of bycatch, occurs when fishing gear (eg. ropes, buoys, nets, fish aggregating devices) and marine debris become wrapped around the animal, weighing it down or hampering its movement – often leading to the animal's death, or serious welfare issues. Small cetaceans can also become entangled in fishing gear such as in gillnets or purse seines, which often leads to the animal drowning [1].

Impacts of entanglement on marine mammals

Although large whale entanglements gain the most publicity, entanglement can affect nearly all marine mammals, including whales, dolphins, pinnipeds and sirenians.

Entanglement can cause drowning, direct injury from ropes and cables, fatigue and starvation. Some species are more vulnerable than others due to morphology, life history and migration patterns. For example, humpback whales are vulnerable due to their long fins and movement near coasts [2]. Among some species, entanglement in fishing gear is a major cause of death [3].

Research suggests that over 300,000 cetaceans die annually from entanglement in fishing gear, although this should be considered extremely conservative, as most entanglements are not observed and/or reported [3]. Pinnipeds are particularly vulnerable to entanglement in marine debris, while dolphins and porpoise may become entangled in fishing nets, debris and aquaculture activities.

Management strategies to minimise the impacts of entanglement on marine mammals

Some management strategies may involve the prohibition of certain activities, such as crab fisheries, aquaculture or commercial fishing within the MPA, or within key marine mammal areas within the MPA, or seasonal closures.

Where activities pose a risk, the use of less-threatening techniques, such as 'rope-less trap' technology or excluder devices for crab and lobster pots can be enforced or encouraged [4]. Rope-less fishing for crustaceans could result in clear benefits to cetaceans and other marine life, as in the absence of end lines in the water column, the risk of entanglement is virtually eliminated [5]. Acoustic deterrents and other strategies have been applied around installations such as aquaculture farms.

Public awareness campaigns directed at all marine users can focus on actions to prevent entanglement, such as using safer fishing practices, and response and reporting actions should an entangled marine mammal be found. All; reported entanglements (whether the animal is alive or dead) can then be entered into a database to be used in efforts to help reduce future entanglements.

When an entanglement occurs, formal, best-practice response strategies should be in place, with a reporting procedure, and trained responders available. In many cases, a national agency, such as NOAA, will be responsible for coordinating and training a network of responders [6].

Bycatch

Bycatch is the term given to the accidental capture of marine life in fishing gear. It is a global issue, affecting many different species including seals, turtles and sea birds as well as non-target fish species. It's estimated that at least 500,000 cetaceans are caught in this way every year [7]. This equates to more than 800 whales, dolphins or porpoises each day, and explains why bycatch is now seen as by far the single most serious, direct threat to cetaceans. Bycatch of cetaceans occurs in all kinds of fishing operations: from large industrial to localised artisanal fisheries. The scale of the problem means effective mitigation is only possible if many different organisations, disciplines and stakeholder groups work together with the fishing community, and consideration is given to the social, economic and environmental aspects of the problem [1].

The IWC Commission has established the Bycatch Mitigation Initiative (BMI). The overall aim of the BMI is to raise awareness on the need for action on cetacean bycatch at both national and international levels and to promote the use of effective tools to understand and tackle the issue. To be fully effective the BMI will need to work closely with experts from multiple disciplines and other international frameworks and organisations which have established the mandate to manage fisheries.
Marine mammal Bycatch factsheet

Case study

Banks Peninsula Marine Mammal Sanctuary (New Zealand)

Hector's dolphin (Cephalorhynchus hectori), found only within New Zealand waters, is currently listed as endangered. In response to threats of entanglement and by-catch from fishing, the Banks Peninsula Marine Mammal Sanctuary was gazetted in 1988. Covering 413,000 ha, the sanctuary extends 12 nmi out to sea.

Within the sanctuary, there is a year-round ban on amateur set-net fishing, and seasonal set-netting restrictions are in place. While the survival rate within the sanctuary, this was considered insufficient to allow population recovery. Therefore, broader management actions were introduced across the majority of the species' range, including a ban on gillnetting within 4nmi of the coast in some areas and 2 nmi of the coast in others. Other strategies have involved fishing awareness campaigns, changing fishing methods, and substantial research using compulsory reporting of entanglement and bycatch and encouragement to report sightings. Early indications of population recovery illustrate the frequent need to extend management beyond small and medium-sized MPAs, even for relatively sedentary coastal species.

Threat Management Plan for Hector's and Māui dolphin
Banks Peninsula Marine Mammal Sanctuary

Resources & references

Additional resources

- *The IWC Expert Advisory Panel on Entanglement Response*
- *Principles and guidelines for large whale entanglement response efforts*
- *Review of Methods Used to Reduce Risks of Cetacean Bycatch and Entanglements*
- *International Whaling Commission's Bycatch Mitigation Initiative*
- *Bycatch Management Information System (BMIS)*
- *The Bycatch Consortium*
- *Bycatch Assessment Tool (ByRA GIS Toolkit)*
- *Developing a Marine Mammal Bycatch Prevention and Reduction Plan (flow diagram) – Page 7 -8 of Guidelines to prevent and reduce bycatch of marine mammals in capture fisheries*
- *FAO Voluntary Guidelines on the Marking of Fishing Gear*
- *FAO Bycatch in small-scale tuna fisheries: a global study*

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Marine mammal Bycatch (fishing)

Addressing the activities and threats

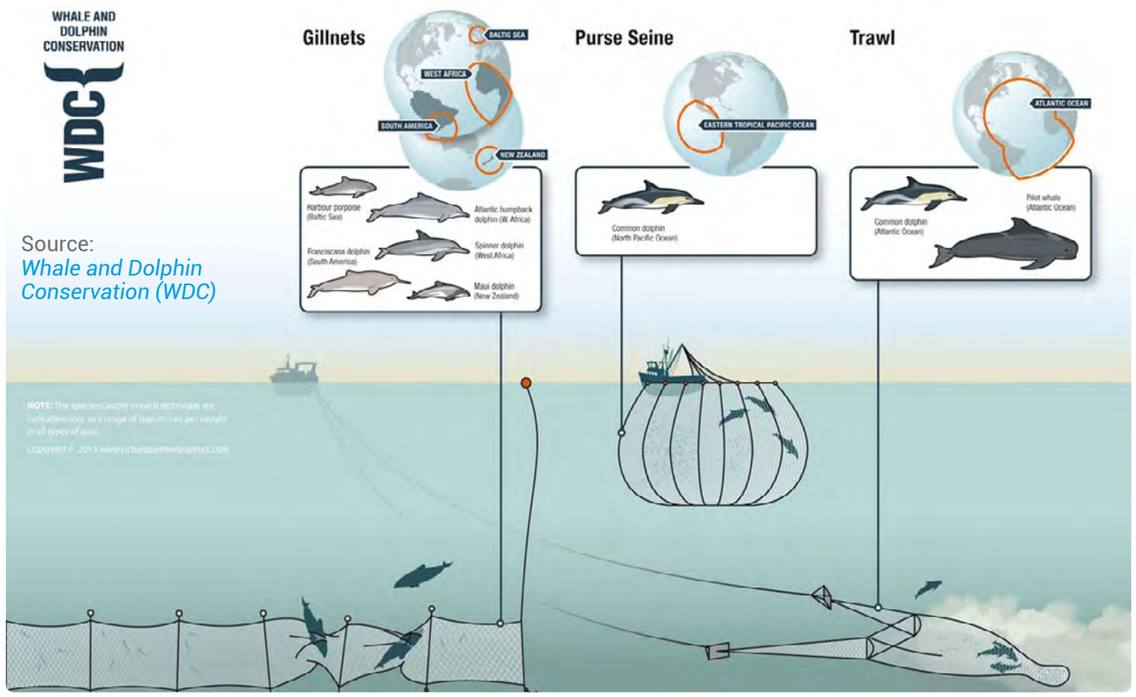
Co-authored by Bianca Cisternino, Bycatch Coordinator, Whale and Dolphin Conservation (WDC)

Introduction

Marine mammal bycatch is the term given to any marine mammal adversely affected as a result of being unintentionally captured in fishing gear such as nets, lines, traps, or hooks, or otherwise impacted by fishing gear [1, 2]. Bycatch has long been recognised as the main anthropogenic threat to marine mammal species globally, hindering the persistence and recovery of many marine mammal populations [2, 3]. It is estimated that more than 500,000 marine mammals are incidentally captured each year on a global scale [3].

Impacts of bycatch

Marine mammal bycatch occurs in all kinds of fishing operations, from large industrial to localised artisanal fisheries, and can be a result of mobile or fixed fishing gears [2, 5]. The major fishery gears contributing to marine mammal bycatch include gillnets, trawls, purse seines, longlines, and pot/traps [5]. Gillnets are identified as the highest risk fishing gear for marine mammal bycatch [6] however, threats from specific fishery gears range between species and cetacean groups with Baleen whales at high risk from buoy lines [7] with baited longlines posing a significant threat to toothed cetaceans [8]. Ghost fishing, a threat from discarded, lost, or abandoned gear, also causes high mortality amongst marine mammals [9]. Pinnipeds are also major victims of bycatch and pinniped mortality estimated in the hundreds of thousands with significant interactions from trawls [8].



Source:
Whale and Dolphin Conservation (WDC)

Strategies to reduce marine mammal bycatch

Due to the dynamic nature of fisheries and different types of interactions with marine mammals, each fishery should be handled on a case-by-case basis to determine the appropriate strategies to reduce bycatch.

1. **Area Closures / Fishery Closures:** Marine spatial management actions, including Marine Protected Areas (MPA), and fishing closures to reduce marine mammal bycatch will vary with the particular marine mammal species at risk, and the type and extent of existing or potential fisheries in and around the area. A total ban on fishing within an MPA, for example, is appropriate and essential for removing fishing gear from the habitat of critically endangered species. However, due to the highly mobile nature of most marine mammal species, adaptive management with spatial and temporal closures that change based on marine mammal population movements will provide the most complete form of protection [11]. More common strategies include bans or restrictions of gear types within a particular area, restrictions within critical marine mammal areas inside a protected area, or seasonal restrictions.

2. **Changes to Fishing Gears and Practices:** The use of alternative gears for high-risk fishing gear for bycatch can reduce potential entanglements such as the use of rope-less gear or sinking lines on pots/traps, whale-safe hooks for longline fishing, reduced gillnet length, thinning twine diameter, or switching gears completely (for example, longlines to pole and line fishing, gillnets to pots/traps) [12].

   Technological and sensory strategies can be used for bycatch mitigation such as the use of acoustic deterrent devices (pingers), light emitting diodes (LEDs), acoustic reflective nets, alternative bait types, changes to gear colours, exclusion devices for trawls, or various types of pot/trap guard designs may all be useful, depending on the species of marine mammal concerned and the interactions observed [5].

   Fishing practices can be altered to reduce the risk of bycatch and must be done in close collaboration with fishers. Reducing fishing effort and soak times, altering the time of day when fishing operations occur, and changing the depth to which gear is set, can all limit the amount of fishing gear interactions with marine mammals [13].

3. **Monitoring:** For robust bycatch monitoring, the use of remote electronic monitoring (REM) is the optimal choice to obtain verifiable and accurate data on entanglements of marine mammals [14]. Bycatch monitoring should involve compulsory reporting of marine mammal bycatch using REM or at-sea observers, with data centrally maintained and used in research for the purpose of minimising bycatch.

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Case study

Banks Peninsula Marine Mammal Sanctuary (New Zealand)

Hector's dolphin (Cephalorhynchus hectori), found only within New Zealand waters, is currently listed as endangered. In response to threats of entanglement and by-catch from fishing, the Banks Peninsula Marine Mammal Sanctuary was gazetted in 1988. Covering 413,000 ha, the sanctuary extends 12 nmi out to sea.

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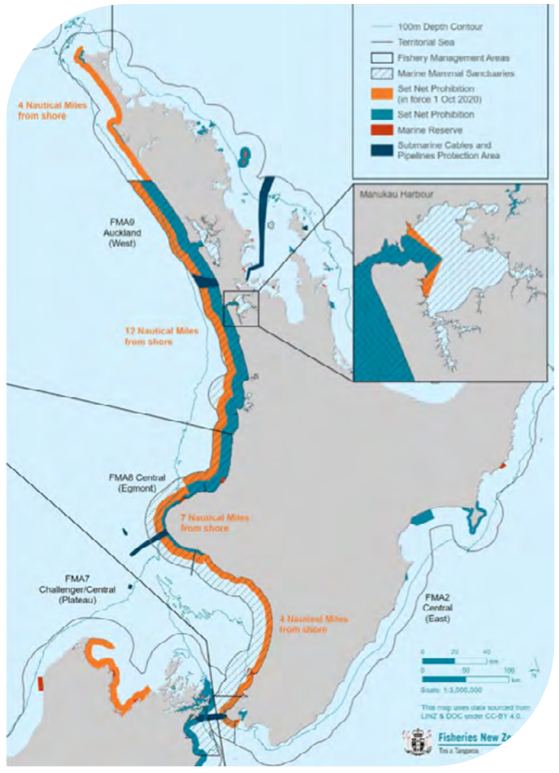
Threat Management Plan for Hector's and Māui dolphin Banks Peninsula Marine Mammal Sanctuary

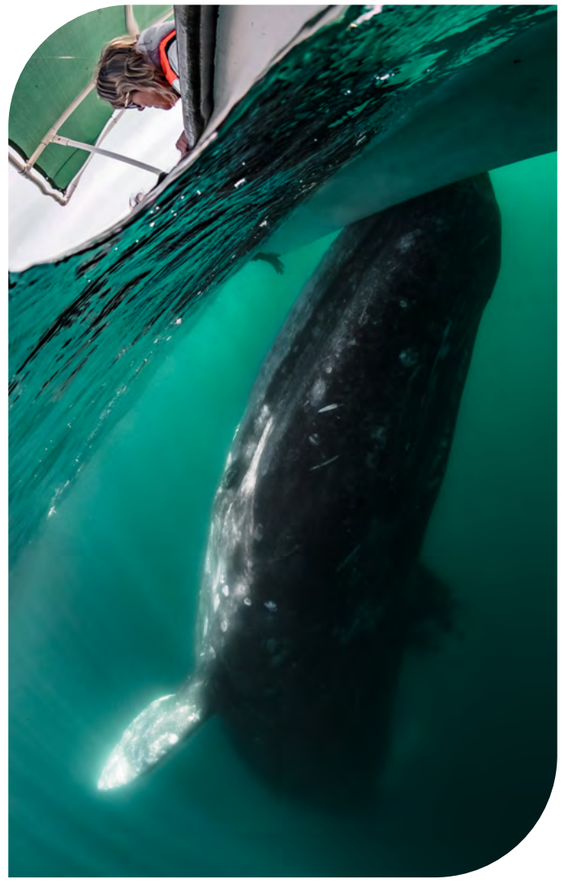
Image credit; Commercial and recreational set net prohibition areas off the west coast of the North Island – Hector's and Māui Dolphin Threat Management Plan 2020



Resources & references

Additional resources

- *Best Practices for Assessing and Managing Marine Mammal Bycatch Factsheet (LENFEST Ocean Program) [.pdf]*
- *Marine Mammal Bycatch Impacts Exploration Tool [Tool]*
- *Cost-benefit Analysis for Mitigation Measures in Fisheries with High Bycatch [.pdf]*
- *International Whaling Commission expert panel for Bycatch [Web-page]*
- *Cetacean bycatch fact sheet (WWF 2018) [.pdf]*
- *International Whaling Commission's Bycatch Mitigation Initiative [.pdf]*
- *Principles and guidelines for large whale entanglement response efforts [web-page]*
- *Review of Methods Used to Reduce Risks of Cetacean Bycatch and Entanglements [web-page]*
- *An illuminating idea to reduce bycatch in the Peruvian small-scale gillnet fishery [Article]*
- *Criteria and case definitions for serious injury and death of pinnipeds and cetaceans caused by anthropogenic trauma [Article]*
- *Guidelines for the Safe and Humane Handling and Release of Bycaught Small Cetaceans from Fishing Gear – CMS Technical Series No.43 [.pdf]*
- *Bycatch Management Information System (BMIS) [Tool]*
- *The Bycatch Consortium [web-page]*
- *Bycatch Assessment Tool (ByRA GIS Toolkit)[GIS-Story]*
- *Developing a Marine Mammal Bycatch Prevention and Reduction Plan (flow diagram) – Page 7 -8 of Guidelines to prevent and reduce bycatch of marine mammals in capture fisheries [.pdf]*
- *FAO Voluntary Guidelines on the Marking of Fishing Gear [.pdf]*
- *FAO Bycatch in small-scale tuna fisheries: a global study [.pdf]*



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9. *Papahānaumokuākea Marine National Monument.*
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Good pratices

- *ByCatch Risk Assessment Toolkit (BYRA)*

Collision/strike

Addressing the activities and threats

Introduction

A collision or ship strike can be defined as the forceful impact between any part of a watercraft, and a live marine mammal, often resulting in death, major injuries or physical trauma, (although these injuries may not always be externally visible) [1]. Virtually any type of vessel may be involved, from large cargo vessels and cruise ships to small outboard recreational craft. Any type of marine mammal may be impacted, from large and small whales, through dolphins, pinnipeds and, in some areas, sirenians (manatees and dugongs). They can occur in the open ocean, high-traffic areas such a shipping lanes and inshore areas including ports.

Factors affecting the numbers of vessel strikes on marine mammals

A major factor affecting the numbers of ship strikes on marine mammals is the volume of shipping traffic, which increased fourfold between 1992 and 2012 [2] and continues to increase at a rate of around 2-3% per year. In 2020, it was estimated that there were 98, 140 commercial ships over 100 gross tons operating globally. This does not account for non-container vessels [8]. Ship-based travel has also escalated, with fast-passenger ferries traversing coastal areas that are regularly used and/or inhabited by whales and dolphins [3].

Vessel speed has been identified in many studies to affect the likelihood of collision and injury to the animal [4]. Speed limits of 10 knots have frequently been applied in sensitive areas.

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The spatial relationship between areas of high vessel activity and areas of high marine mammal density, whether at the international shipping or local scale, greatly impacts the possibility of ship strike. This has become a major focus of research in order to mitigate ship strikes. For example, the IWC collects, and analyses historic and current reported ship strikes on a global scale to identify key hot spots where high numbers of whales coincide with busy shipping lanes [5]. As of May 2016, 1, 200 have been recorded by IWC. Other studies and strategies work at the level of individual MPAs [6]..

Strategies for reducing vessel strike

Data collection is vital in order to understand a) areas of high vessel traffic, b) the distribution and abundance of marine mammals, and c) hotspots for vessel strike. Managers and scientists rely on reports of known collisions, which should be compulsory, stored for analysis, and reported to the IWC for their database [5].

Data analysis effectively brings together a, b, and c) above, to undertake risk assessments for species based on known distribution, critical habitat, vulnerability to vessel strike and vessel traffic. Spatio-temporal studies can also inform management regarding mitigation strategies through the identification of hotspots for vessel-strikes, and seasonal factors.

Mitigation strategies essentially involve keeping vessels away from marine mammals, reducing speed, and promoting awareness vessel operators. They may involve speed limits for large vessels and/or speed limits for all vessels within critical marine mammal habitats, or seasonal bans in certain areas. Vessel routing (traffic separation schemes) may be particularly useful in reducing the risk to whales from large ships [7].

The IWC Global Ship Strikes Database

In 2007, the IWC launched an initiative to collect and analyse information about reported ship strikes, both historic and current, and on a global scale. The aim of this work is to identify 'hot spots' where large numbers of whales coincide with busy shipping lanes. Once this information has been checked and analysed, it will be shared with the widest possible range of stakeholders to help develop mitigation actions that are targeted and effective.

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Resources & references

Additional resources

- *Protecting Blue Whales and Blue Skies*
- *National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna*
- *Advice to help avoid collisions with whales*
- *Guidelines for the development of national networks of cetacean strandings monitoring*
- *Mitigation of vessel-strike mortality of endangered Bryde's whales in the Hauraki Gulf, New Zealand*
- *Effectiveness of mandatory vessel speed limits for protecting North Atlantic right whales*
- *A global Review of Vessel Collision with Marine Animals*
- *2021 – Report of the Pelagos workshop on Ship Strikes: A Particularly Sensitive Sea Area in the North-West Mediterranean Sea, Italian Ministry of Ecological Transition Pelagos Agreement*

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5. *IWC Ship strikes*
6. *IWC Vessel Strikes – Stellwagen Bank National Marine Sanctuary*
7. *NOAA Fisheries. Reducing Ship Strikes to North Atlantic Right Whales.*
8. *United Nations Conference on Trade and Development: Review of Maritime Transport 2020*

Strandings

Addressing the activities and threats

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Introduction

Marine mammal stranding is generally associated with cetaceans, but can involve any marine mammal, including sirenians and pinnipeds. In the broadest sense (and possibly the most useful for MPA managers) stranding may include animals on the shore that are unable to return to the water under their own power, those seemingly in need of medical attention, those in the water that cannot return to their own natural habitat without assistance, or dead animals on the beach or in the water [1].

Causes of cetacean stranding

Stranding may occur due to natural factors such as age, disease or navigational errors, or from human-related factors such as bycatch, vessel collisions and environmental degradation. Causes are often thought to be a combination of natural and human factors [2]. A stranding can involve a single individual of any species, or a mass stranding, which usually involves toothed whales (e.g. pilot whales).

The term mass strandings refers to the simultaneous stranding of two or more cetaceans (of the same species), but not including a female and her calf [5]. They are thought to be mostly the result of navigational errors, or following a sick individual into unfamiliar shallow water, although active sonar may on occasion play a role [3]. Single animal strandings are often caused by disease, parasite infestation, harmful algal blooms, injuries from ship strikes or fishery entanglements, pollution exposure, trauma, and starvation [1]. In many cases, a beach-stranded animal has died at sea and has washed up onto land.

Marine mammal strandings are therefore not so much an impact in themselves, but rather a visible symptom of natural or human-induced processes.

Managing marine mammal strandings

There are two major elements to managing marine mammal stranding.

1. *The rescue of living stranded animals (or the humane euthanasia of those that cannot be rescued).*
2. *The collection of data for research into marine mammal biology and impacts from human activities. The difficulty in studying marine mammals means that, in the case of some rare species, most biological information comes from stranded animals [2].*

Public communication forms an important part of stranding management by providing easily- accessible information on how to respond to and report strandings in a timely manner. Outreach may also use stranding data to increase public awareness of cetaceans and the threats they face.

A system of emergency response to attend to live strandings, transport live animals, apply medical treatment, and if possible refloat the animal, requires specialist training. Most often (when it exists), this takes the form of a regional or national network run by an agency such as NOAA [1] or the UK Cetacean Strandings Investigation Programme (CSIP).

Dead animals provide an opportunity to learn more about the biology of often difficult-to-study species and their threats. However, to maximise the value of this information, trained people are required to perform necroscopies and analyse mortality. Scientists (whether from government agencies, collaborators, and/or MPA personnel) may be able to identify population-wide health problems with possible remediation actions based on the examination of stranded or bycaught individuals. However, there are some discussions around the extent to which this is possible based on innate biases, because a stranding event is the result of physical, social and biological processes, and whilst any increase or decrease in strandings could reflect a possible change in abundance and/or mortality, it may also be a function of variations in environmental, sea and climatic conditions, observer effort or a combination of these and other factors [5]. These biases should be taken into account when attempting to make population level inferences. All stranding data should be centrally aggregated and maintained for research [3].

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Case study

The Strandings Initiative

In 2016, an IWC multi-disciplinary expert workshop discussed how best to develop practical guidance on handling cetacean strandings. The workshop concluded that an international Strandings Initiative should be established under the auspices of the IWC, incorporating the skills and experiences of strandings experts from a range of different countries around the world.

In addition to sharing best practice and producing globally agreed guidelines on strandings response, the workshop stressed the important role of the Strandings Initiative in collating and co-ordinating data from national strandings networks. Standardized, global data is vital to understanding the causes of cetacean stranding and addressing those causes which are man-made.

The Strandings Initiative was launched in 2017. It is led by an expert Strandings Co-ordinator, advised by a multi-disciplinary Expert Panel, and overseen by a Steering Group drawn from the Commission's Scientific and Welfare Committees.
As well as member governments, the Strandings Initiative is engaged with other intergovernmental organisations, academic institutions, regional and national strandings networks.

Training

The SPAW-RAC, within the framework of the CARIMAM project, and in collaboration with Gabriela Hernández-Mora (National Service of Animal Health of the government of Costa Rica) and Caroline Rinaldi (Association Evasion Tropiclae, Guadeloupe), has developed an online training course composed of videos, to support stakeholders who wish to strengthen the marine mammal stranding monitoring network in their territory or develop one.
The first 4 videos cover the following topics : 1) introduction to stranding networks, 2) recommendations for developing a stranding network in a territory, 3) recommendations for intervening on a stranding, 4) recommendations for collecting data and samples on a stranded animal. Each video is about 30 minutes long ; they are in English but Spanish and French subtitles are available. They can be viewed online on the CARIMAM YouTube channel *here*.

Resources & references

Stranding Response Resources

- *The most up-to-date and best practice guides and resources to respond to stranding, presenting both general guides and regional advice, have been collated.*
- *Access the Stranding Response Resources*

Additional resources

- *Mediterranean Database of Cetacean Stranding*
- *Local strandings response network*
- *IWC Expert Panel on Strandings*
- *Guidelines for the development of national networks of cetacean strandings monitoring*

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2. *IWC Strandings*
3. *Why do Cetaceans strand?*
4. *ACCOBAMS website*
5. *A Stranding Guide to the Marine Mammals of the Wider Caribbean Region*
6. *Best Practice on Cetacean Post-mortem Investigation and Tissue Sampling (June 2020)*

Climate Change Implications on Marine Mammal Management

Addressing the activities and threats

Introduction

Climate change severely affects marine life worldwide with warming oceans generating unprecedented cascading effects that include the melting of polar ice, rising seas, marine heatwaves, and ocean acidification. Regardless of their body size, habitat, or ecology, marine mammals will have to deal with the consequences of this global warming. Climate change has already caused a range of direct and indirect effects on marine mammals including an increase in infectious disease outbreaks, a reduction in breeding success for some species because of rising temperatures and a subsequent sea ice loss, and habitat shifts likely driven by the need to track changes in prey availability (also due to climate change) [1-3]. These range shifts are expected to continue for several marine mammal species globally for the upcoming future as climate conditions will worsen [4, 5].

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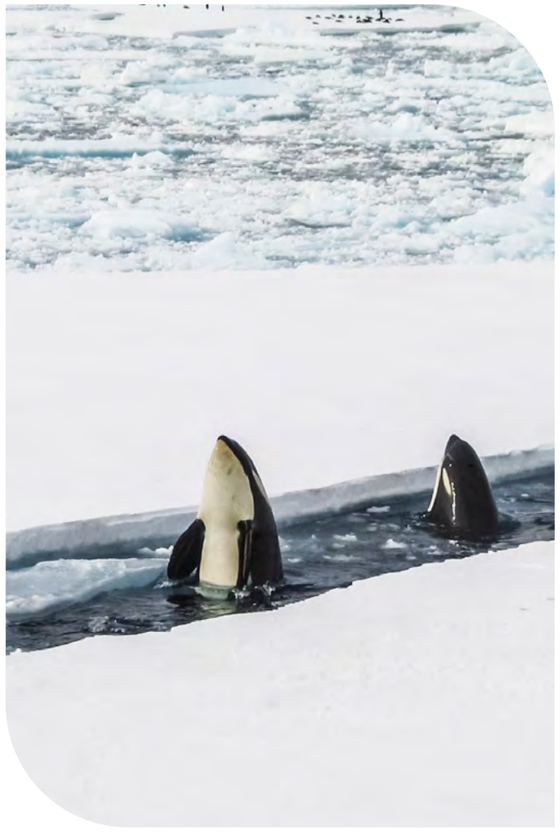

Implications for the ecosystem

Marine mammals are keystone species contributing to various ecosystem functions responsible for the stability of the carbon cycle and the maintenance of biodiversity worldwide. As apex- and mesopredators, they control the abundance of their prey species, thus helping to maintain the often delicate balance between different species in the marine environment (i.e., top-down regulation) [6].

Cetaceans (especially the great whales) are also known to be '*marine ecosystem engineers*': they facilitate the transfer of nutrients such as nitrogen and iron from deep waters to the surface, and across latitudes via migration from feeding to calving areas. This worldwide transfer of nutrients is known as the 'whale pump' [7, 8] and enhances the primary productivity and krill abundance in the marine ecosystem. When they die, whales further sequester large amounts of carbon to the deep sea which contributes to natural climate-change mitigation [9].

By shifting their distributions to other, more suitable areas in response to climate change, marine mammals also move these services which could affect wider ecosystem functioning and destabilize ecological processes, particularly at local scales in the areas that were abandoned by the cetaceans.

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Implications for the species

Depending on mobility and habitat requirements, some species/populations show strong site fidelity and may be unable to shift their distribution to track suitable habitat. This would constrain the species to remain in a suboptimal environment and/or exposing them to substantial habitat loss (e.g., due to reduction in sea ice crucial for breeding). For example, in response to sea ice loss, some ice-dependant coastal species such as seals, polar bears, and even small cetaceans, may not be able to traverse oceans to reach a more suitable different coastline. Therefore, these species may not be able to adapt their lifestyle without significant risk of biological consequences to health such as reduced body condition and potential immune suppression.

Even the species that are able shift their distribution to track newly suitable habitats (and avoid newly unsuitable habitats) and prey availability, are not necessarily safe. Moving to new areas can expose them to a broad range of new challenges such as dealing with suboptimal environmental conditions and contaminants, new predators, and having to compete for resources with indigenous species (interspecific competition). Those new challenges are cumulative, adding to the toll taken by the energy expenditure for these moving species to find new habitats.

Implications for humans

Many of the ecosystem-level changes will impact humans as Humanity depends directly on Earth's ability to support a complex variety of living species [10] The benefits provided by biodiversity include products, cultural services that give us aesthetic, spiritual or recreational value, and major ecological processes, which regulate everything from the climate to the carbon, water, and nitrogen cycles [11]. However, there are also more direct implications of climate change on marine mammals for humans, such as the economic value marine mammal tourism brings to both local communities and nationally to many countries. Locations where both direct and in-direct employment demographics are reliant upon whale watching activities would be particularly impacted by climate change.

Mitigation strategies

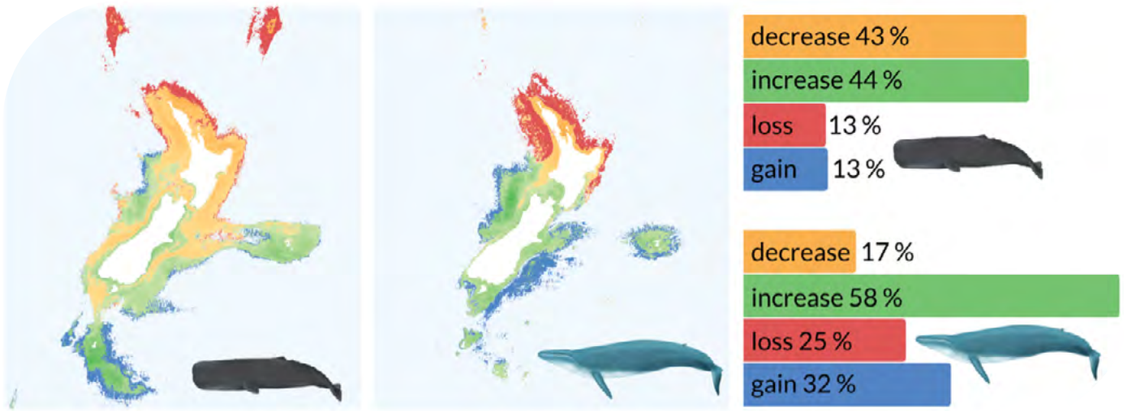
To incorporate management actions that help mitigate the impacts of climate change on marine mammals, the first step is to identify how the species in question may be affected by climate change. This information can then support management decisions specific to the relevant threat. For example, if a species suffers from loss of prey species due to climate-related shifts in prey distribution, increased regulation of fisheries in specific areas may be possible to mitigate resource depletion.

To gain an understanding how species may be affected, it is vital to collect long-term data on marine mammal distribution and abundance, and to monitor environmental variables such as sea surface temperature, sea ice concentration, and primary production, but also wider ecosystem data such as prey availability [2, 3]. This allows the establishment of a baseline in relation to which changes can be detected. By using tools such as habitat modelling, areas of high importance for the respective species can be identified within the MPA and thus give increased protection priority [12].

These approaches may require collaborative efforts across a range of disciplines, including marine mammalogy, marine ecology, oceanography, and climate modelling. Additional methods to explore the impact of climate change in recent decades including the exploration of physiological changes in marine mammals in respect to climate change should further explored.

To support any conservation actions targeted to mitigate the impacts of climate change on marine mammals, it is recommended to reduce non-climate-related stressors on marine mammals in an effort to increase species' resilience[3], for example noise pollution and disturbance via recreational vessels, fisheries interactions including bycatch and entanglement in fishing gear, and pollution [13].

Case study



Climate Change will cause sperm and blue whales to seek higher latitudes (New Zealand)

Sperm (*Physeter macrocephalus*) and blue (*Balaenoptera musculus*) whales are potential good indicator and sentinel species because of their extended life span and sensitivity to seasonal environmental shifts in their prey distribution and abundance [14,15,16]. Therefore, identifying how environmental shifts will shape the distribution of these species can serve as an early warning system to anticipate current or potential ecosystem changes.

Using the whales' present distributions and a combination of mathematical models, we built a set of environmental "rules" that dictate where each species can live. Using climate-dependent data such as sea-surface temperature and chlorophyll A (a measure of phytoplankton growth), and static data such as water depth and distance to shore, we applied these rules to forecast future habitat suitability at the end of the century based on three climate change scenarios of differing severity outlined by the Intergovernmental Panel on Climate Change (IPCC).

Our results show a clear southward shift for both species, mostly driven by rising temperatures at the sea surface. The most severe climate change scenario tested generated 56% and 42% loss and decrease of currently suitable habitat for sperm and blue whales, respectively, mostly in New Zealand's northern waters. These predicted changes will have a strong impact on the ecosystem functioning and services in New Zealand's northern waters but also in coastal areas (critical for the species' foraging and survival). Furthermore, a shift in sperm whale distribution causing fewer and less reliable sightings around Kaikōura on the South Island of New Zealand, would likely negatively impact both the tourism and wider hospitality industry in the region. Not only do these simulated range shifts help to identify future potential climate refugia to mitigate a global warming, they also generate a range of socioeconomic consequences for island nations relying on wildlife tourism, industry, and environmental protection.

Projected change in habitat suitability by 2100, for sperm (left panel, top bar chart) and blue (right panel, bottom bar chart) whales under the most severe IPCC climate scenario assuming no mitigation (RCP8.5). Percentages are expressed as relative to each species' present-day distribution.
Read more about this study

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Resources & references

Additional resources

- *Future seasonal changes in habitat for Arctic whales during predicted ocean warming*
- *Global vulnerability of marine mammals to global warming*
- *A review of climate change effects on marine mammals in United States water: Past predictions, observed impacts and current research and conservation imperatives*
- *Climate change will re-draw the map for marine megafauna and the people who depend on them*
- *Department of Conservation: Potential climate change effects on*
- *New Zealand marine mammals: a review*
- *International Whaling Commission: Climate Change and Cetaceans*

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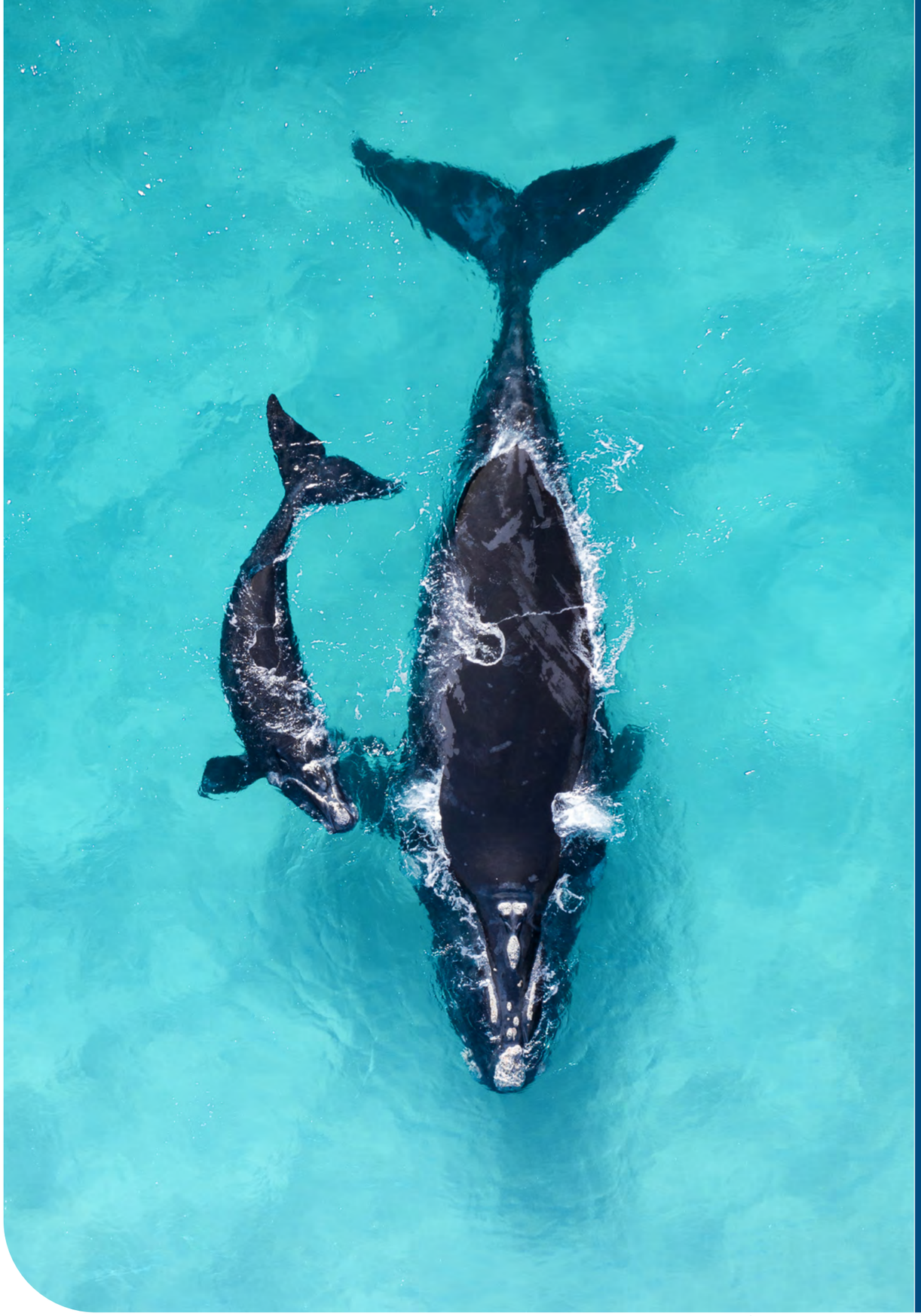

Research and monitoring

Baseline knowledge – ecology of marine mammals, their habitats, and their threats

Research and monitoring

Introduction

Baseline data can represent the current distributions and abundances of marine mammal species, knowledge of the various human activities within the MPA, and the manner in which these activities affect marine mammals. Effective management of an MPA for the protection of marine mammals, or even deciding on the location of, or need for, an MPA should be guided the best available knowledge concerning the distribution of marine mammal species currently within the region, as well as an understanding of their potential threats. However, many species remain very poorly understood, particularly in developing countries [1].

Importance of baseline data

In the case of an MPA specifically created for marine mammal conservation, baseline data should have formed a key component of the MPA's proposal. Ideally, the distribution and abundance of species, the type and intensity of human activities that may affect marine mammals, and the likely impacts of these activities on the relevant species could justify the need for the MPA [2]. However, most MPAs exist for multiple purposes, with detailed baseline data with respect to marine mammals often lacking at this stage.

Baseline marine mammal data should inform the development of the management plan. Species distributions, abundances, diversity and habitat information (in spatial format such as maps or GIS data) are important inputs to zoning plans. By identifying critical habitat [3], the zoning plan can be designed so that the most important areas are given higher levels of protection.

Analyses of the ecological status of marine mammals (health of populations, vulnerability etc.) within the MPA also informs the types of regulations required to protect relevant species. Understanding, communication and considering the aforementioned key data is crucial for the development of efficacious marine spatial management plans whilst ensuring that management plans consider all ecological and socio-economic aspects [4].

Baseline data is also vital in providing a reference with which to compare the results of future monitoring. Only with this can effective temporal and spatial assessments of an MPAs performance be made [5].

Obtaining baseline data

The costs to survey marine mammals, and particularly cetaceans, are often expensive and time-consuming. Baseline marine mammal data should therefore be assembled from all possible existing sources, including published papers, grey literature, consultancy reports, local knowledge and traditional ecological knowledge (TEK) [1]. Similarly, the socioeconomic data required to analyse threats should, as much as possible, be assembled from existing sources such as fisheries agencies.

Collaboration between MPA management and experts, researchers, NGOs, other government agencies and community and user groups (see Factsheets 17 and 18) will help to obtain any existing baseline information

Where MPA management identifies knowledge gaps, it can seek to fill these through targeted surveys including dedicated marine mammal surveys (see monitoring Factsheets) [2].ns and species-specific policies and assessments [5].

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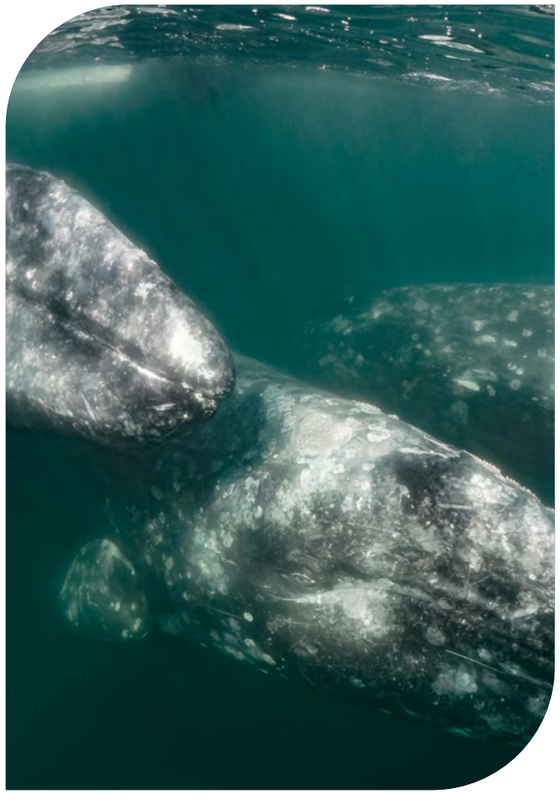

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Case study

Cetacean rapid assessment (Tanzania)

This study, although not focusing on a single MPA, generated a baseline cetacean
dataset along the data-poor Tanzanian coast. Existing distribution records were gathered from a broad suite of sources including published and unpublished information, museums, dive centres, and seismic survey vessels among others.

This information was augmented by dedicated, robust, repeatable surveys, as well as interviews with fishers to determine effort, bycatch and other relevant threats to cetaceans. This methodology allowed the identification of critical cetacean habitat and areas of serious threat, which can then be used to inform management.

Braulik, G. T., Kasuga, M., Wittich, A., Kiszka, J. J., MacCaulay, J., Gillespie, D. (2018). Cetacean rapid assessment: An approach to fill knowledge gaps and target conservation across large data deficient areas. Aquatic Conservation: Marine and Freshwater Ecosystems. 28(1); 216-230

Read more about this study

Resources & references

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Ecological Monitoring - protocols and techniques

Research and monitoring

Introduction

Ecological monitoring, in its simplest sense, involves a systematic collection of ecological data in a standardized manner over time (preferably at regular intervals) for a particular reason [1]. When applied to marine mammal conservation in an MPA, ecological monitoring involves the collection of data that can contribute to research into the health of marine mammal populations, the ecological processes necessary for the maintenance of the marine mammal populations, and the threatening processes that impact marine mammals. Given the cost and expertise required to apply a variety of monitoring methodologies, it is likely that the MPA management will need to partner with other organisations to achieve these aims.

The importance of ecological monitoring of marine mammals

Monitoring of marine mammal populations is integral to the reporting and reviewing the management effectiveness of an MPA (see Factsheet 21). The specific goals of a monitoring programme will vary depending on the characteristics of the MPA. Data from a well-designed monitoring programme should, however, reflect the state of marine mammal populations, and indicate whether management is meeting its objectives [2].

Marine mammals can be indicators of overall ecosystem health. Changes in seal, dolphin and whale populations may reflect changes further down the food chain, changes to climate, and pollution [3].

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Additional baseline data and general ecological information on marine mammals can be collected through a motoring regime. Given the difficulty, expense and time-consuming nature of marine mammal surveys, ongoing monitoring programmes are likely to provide previously unknown marine mammal information within an MPA.

Ecological monitoring methods

The particular monitoring methods employed within an MPA will depend on the scope of the monitoring programme, which in turn depends on the critical questions that need to be answered. The techniques used to monitor cetaceans within an MPA will be driven the size of the MPA, the species present, and available human resources and budget [4].

All methods of monitoring marine mammals have their strengths and limitations. Given the limited (or insufficient) resources of most MPAs, and the difficulty of monitoring large and often wide-ranging animals, cost-effective strategies that utilise local people and MPA users can form an important component.

Some of the more cost-effective methods, though less rigorous, include recording incidental sightings from MPA users and stranding data. This data, though providing some indication of the species found in an area, generally cannot be used for quantitative analyses such as measuring population size [4].

Data collection from tourism operators, as well as citizen science can provide robust data, depending on the species and cost. Citizen science and ecotourism data collection are increasingly used in monitoring, and MPA managers can encourage this. One example is the site Happy Whale, where citizens are encouraged to upload images of whale flukes (tails) to a database, they are identified by their unique markings, and they then can be tracked around the world [5].

Other, more specialised methods will depend on the species, the research goals, and the available resources. These include passive acoustic monitoring, which is particularly useful in monitoring highly-vocal species of cetacean. Observational monitoring from land, sea, or aircraft, and Photo ID may all form a part of the monitoring mix. Satellite tagging is now, especially given the large distances travelled by the larger whales, a widely recognised method of monitoring cetaceans [6].

MPA managers, however, will likely not have the human or budget resources to run all elements of ecological monitoring. Existing scientific institutions are usually brought in as partners to help to design and fund monitoring programmes, and indeed to help define the major issues in the planning phase [2].

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Case study

Olympic Coast National Marine Sanctuary (USA)

Numerous long-term monitoring projects take place within the sanctuary involving a variety of partners, including scientists from multiple agencies, universities, indigenous groups, citizen science groups and others.
A range of techniques are used, depending on the specific goal of the monitoring project. Oceanographic parameters are collected for a number of projects using buoy monitoring arrays.

Sea otters are censused annually using aerial and ground counts. Pinnipeds are monitored using visual line-transect surveys, visual strip surveys, molecular techniques, digital photography, aerial surveys at haulout sites and satellite tagging.

Cetaceans are monitored using passive acoustic recording, ship-based offshore cetacean surveys (visual surveys following line-transect protocols), photo identification catalogues, and satellite tagging.

Olympic Coast National Marine Sanctuary: Science
Olympic Coast Monitoring Inventory

Resources & references

Additional resources

- *Monitoring cetaceans in European waters*
- *Joint cetacean protocol*
- *Evaluating monitoring methods for cetaceans*
- *Strategies for Monitoring Marine Mammal Populations*
- *Detecting and Monitoring Marine Megafauna from Space: Exploring Opportunities in the Northeast Pacific*

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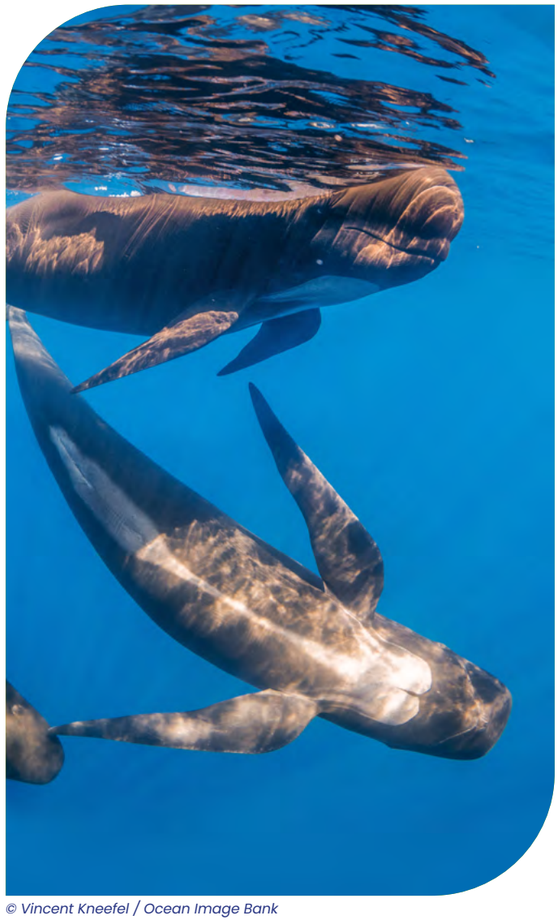
5. *Photographing Whales for Science*
6. *Non-lethal research techniques for studying whales*

Measured ecological variables (by MPA management or partner organisations)

Research and monitoring

Choosing ecological variables to monitor

Within an MPA (or any other area for which marine mammal monitoring is to be undertaken), it must be decided which ecological variables should be given highest priority. The goals and objectives of the management plan should provide a guide, as should the particular activities and threats that occur within the MPA. By monitoring the status and trends of marine mammal populations and the environmental conditions provide a feedback mechanism to the management plan, to ensure that the proposed mitigation measures efficacious [1].



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Basic data informing the management plan

At the very least, the monitoring of diversity and relative abundance of marine mammal species over space and time should be acquired within an MPA in order to identify critical habitat and periods of vulnerability. These are basic data that should be aspired to, as they inform the initial management and zoning plans [2].

Species and threats

The particular marine mammal species found within an MPA, along with the types and intensities of human activities within an MPA, will drive questions that require the measurement of specific variables. In other words, not every ecological measure will be appropriate or require high-level priority. For example, Stellwagen Bank National Marine Sanctuary is subject to intense shipping traffic. Therefore, large whale movement patterns, as well as underwater noise, are monitored in order to seek a solution to vessel strike and acoustic impacts [3]. Where a whale-watching industry is active, such as in the Canary Islands, behavioural variables will often be recorded [4]. Where terrestrial runoff from agriculture is potentially an issue for coastal habitats, physical water parameters in the marine environment may be of high importance.

The need to monitor specific variables may also vary based on the marine mammal species of interest. While the monitoring of noise is especially relevant to some cetaceans [5], central to dugong or manatee conservation is the monitoring of seagrass abundance [6], for example.

Capacity and cost of data acquisition and analysis

The variables that are able to be monitored will be largely dependent on the financial and human resource capacity of the MPA management and partner organisations. While the use of existing data such as incidental sightings and strandings can help establish or add to species lists and rough measures of diversity, variables such as abundance, habitat usage, population structure, behaviour and the impacts of threats become more complex, expensive and require specialised skills. Often, resources will be insufficient to fully implement an ideal monitoring regime; therefore, those variables that are most crucial to the assessment of the management goals should be prioritised [7].

Experts from partner organisations can help to form the monitoring strategy. Expertise and capacity within partner organisations may also influence what variables can be monitored, but the MPA, through direct or indirect funding, can help guide the monitoring by partner organisations.

Case study

The COMPASS

The COMPASS (Collaborative Oceanography and Monitoring for Protected Areas and Species) Interreg 'Marine Mammals' work package has been developed to implement a future-proof passive acoustic monitoring (PAM) programme for marine mammals (cetaceans and pinnipeds) for a cross-border network of MPAs.

Through a network of PAM stations, within current and proposed MPAs, within the border region of the Republic of Ireland, Northern Ireland and Western Scotland, collected data across spatial and temporal scales are recorded from mobile species (including harbour porpoises, dolphins, baleen whales and seals, which are utilised to highlight large-scale seasonal targets.

The analysed data provide support to existing threats from anthropogenic pressures to develop comprehensive management and monitoring plans for MPA networks.

Read more on COMPASS-OCEANSCIENCE.EU

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Resources & references

References

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2. *Clark, J., Dolman, S.J. and Hoyt, E. 2010. Towards Marine Protected Areas for Cetaceans in Scotland, England and Wales: A scientific review identifying critical habitat with key recommendations. Whale and Dolphin Conservation Society, Chippenham, UK, 178pp.*
3. *Stellwagen Bank National Marine Sanctuary: Science*
4. *IWC Whale Watching Handbook: Spain*
5. *Reducing Impacts of Noise from Human Activities on Cetaceans*
6. *Australian Government Seagrass Value Assessment Guidelines*
7. *Kelleher, G. (1999). Guidelines for Marine Protected Areas. IUCN, Gland, Switzerland and Cambridge, UK. xxiv +107pp.*

Frequency of monitoring

Research and monitoring

Introduction

The object of monitoring is to obtain a measure of the health of a population, ecosystem or the impact of an action such as protection. In the case of marine mammals, monitoring frequency should allow a representative measure of abundance or habitat usage. Monitoring frequency depends on factors including the goal of the monitoring programme and the availability of resources. It also depends on whether a species is migratory, sedentary, or uses local different local habitats throughout the year.

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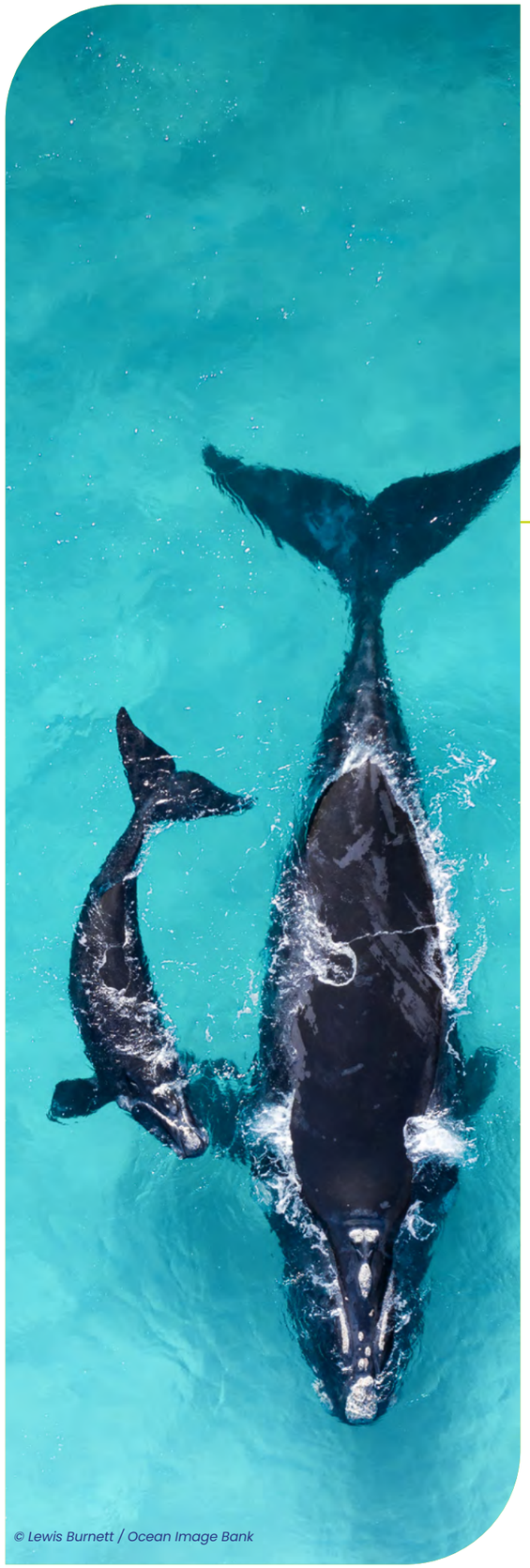
Migratory species

If migratory species travel throughout, within or between the MPA(s) on an annual migration, then there is little need to monitor at other times. Therefore, Humpback whales in South-east Queensland, for example, need only be monitored for the period during which they are traversing the region [1]. Regular annual surveys are preferable to less-frequent monitoring, as some species may exhibit natural inter-annual variability. For example, the distribution of some cetacean species have been known to change in El Nino years [2].

Resident species

Resident marine mammal species often reside in the one area, but many species show a variety of movement behaviours at a location. For example, around Tenerife, in the Canary Islands, some short-finned pilot whales are resident, some undergo small-scale migrations, and some are thought to be transient [3]. Therefore, the monitoring frequency should reflect the goal of the monitoring. If the purpose of the monitoring is to generate an absolute or relative census, then once per year or every two years may be sufficient. However, where monitoring relates to, for example, habitat use over time, or developing an understanding of subpopulations, multiple surveys may be required each year.



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Physical parameters

Physical oceanographic monitoring (depending on the particular parameter) can be measured in different ways, from satellite imagery to moored buoys, to boat-based sampling. Most of these parameters vary throughout the year and are likely to vary from week to week as a result of weather events. Therefore, weekly, monthly or quarter-annually monitoring is preferable where resources and available skills permit [4].

Resources & references

References

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2. *Dawson S., Wade P., Slooten E. and Barlow J. 2008. Design and field methods for sighting surveys of cetaceans in coastal and riverine habitats. Mammal Review 38 (1): 19–49*
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4. *IUCN Portal: Pomeroy R.S., Parks J.E., Watson L.M. 2004. How is your MPA doing? A guidebook of natural and social indicators for evaluating marine protected area management effectiveness. IUCN, Gland, Switzerland and Cambridge, UK. 234 pp*

Data sharing

Research and monitoring

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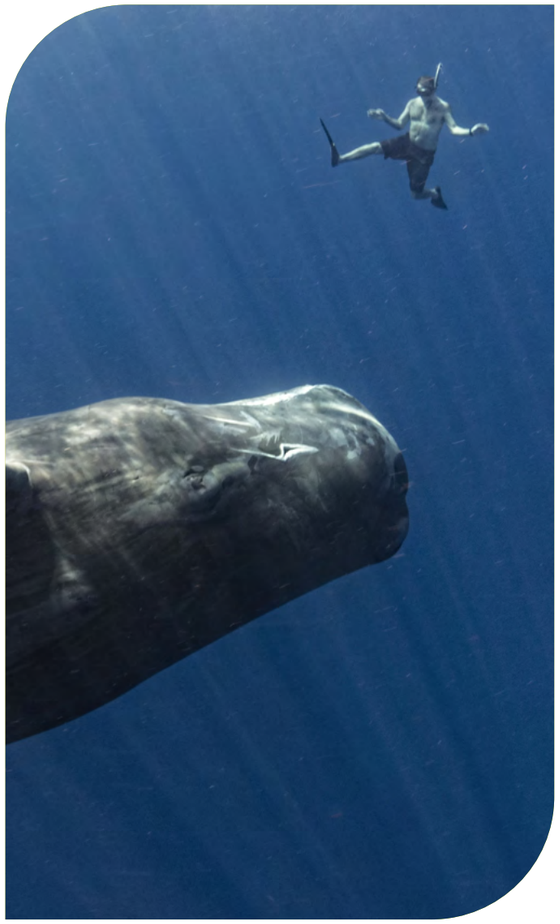

Introduction

Given the complexities inherent in MPA management, and the holistic and integrated approach that should be taken in the design and management of MPAs, an extremely broad, diverse range of data is required [1]. Given the limited resources sometimes available to managers, and the expense of the data collection, data sharing between agencies, and between agencies and researchers ensures that the limited funding available for data collection is used efficiently and the demand on resources is lessened. Similarly, in the interests of data access, transparency, accountability and goodwill, monitoring and reporting information can be placed online by MPA management for easy public access to further facilitate bi- and multi-lateral collaboration.

Sharing monitoring and reporting data

For an MPA to be adaptively managed in an evidence-based manner, data collected or housed within other government agencies may be required. This could include socio-economic or demographic data or may relate to military, transportation, ocean pollution, transport or other information. Substantial monitoring data that are collected for Environmental Impact Assessments (EIA) may be held by private consultants, while NGOs also frequently collect data useful to MPA managers [2]. Researchers often collect data that may be of use to MPA management or other researchers, although authors may be held to journal-set restrictions on releasing collected data until respective publications are published. Even following publication, the data may not be available and restricted by a paywall. In these instances, MPA managers should explore the many available open access tools and networks to access literature.

EIAs may be of value to MPA managers, whether or not the proposal is set to be implemented within the MPA. However, the ownership and availability of these data to government agencies and researchers can be complex and varied [4].

Online availability of data and reports

Data sharing has undergone a revolution in recent decades with the development of broadband internet and online data access software. Reporting is increasingly made available online by MPA managers, spatial data have been, for some time, disseminated in this way. More recently, actual survey data are being placed online for reasons of accessibility, value-adding, and transparency.

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Case study

Great Barrier Reef Marine Park (Australia)

The Australian Institute of Marine Science (AIMS) has, in partnership with the Great Barrier Reef Marine Park Authority (GBRMPA), for 30 years been collecting and analysing coral, fish and disturbances within the park for the Long-term Monitoring Program. This information informs reef managers, government and stakeholders about the status of the reef's health.

Monitoring reports, maps and summaries of reef health have been published on the AIMS website for many years. However, the data used to generate the reports is available online. This allows scientists to use the data for further studies and provides for scientific scrutiny.

Read more on GBRMPA website

© NOAA / Long-term passive acoustic recorder moorings are deployed every year or half-year. Data are extracted after retrieval and processed back in Seattle.

Resources & references

Additional resources

- *Fluke Book: A.I. for cetacean research*
- *OBSENMER*
- *CAR'SPAW RAC Strandings Network*
- *Australian Marine Mammal Centre National Marine Mammal Data Portal*
- *ASCOBANS Web-Accessed Database for Marine Mammal Stranding and Necropsy Data*

References

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2. *Berdej SM, Armitage DR (2016) Bridging Organizations Drive Effective Governance Outcomes for Conservation of Indonesia's Marine Systems. PLoS ONE 11(1): e0147142*
3. *Australian Government: Data sharing*
4. *European Commission: DG Maritime Affairs and Fisheries (2008). Legal aspects of marine environmental data. Framework Service Contract, No. FISH/2006/09 – LOT2*

Socio-economic monitoring

Research and monitoring

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Introduction

MPAs are designated and designed for a variety of purposes, and even among MPAs with the conservation of fauna and/or flora as a primary focus, most contain a variety of human activities. Every MPA is therefore a human as well as an ecological system. The creation of an MPA, or management decisions applying to an MPA, may impart a range of financial and non-financial benefits, but may also impart costs to some groups due to restrictions on access to resources [1]. MPA management plans could also place key social values at risk to a range of stakeholders and communities such as cultural and traditional practices and uses.

Socio-economic monitoring provides vital information on the distribution and intensity of potentially threatening activities within the MPA, and the economic costs and benefits of the MPA for different industries. By increasing MPA users', specific user groups', and the public's understanding of the economic value of conservation activities within the MPA, conflict may be reduced [2].

Economic value of marine mammals in the MPA

MPA management in order to protect marine mammals must often compete against other uses, such as the shipping or fishing industries. Therefore, studies on the economic value of marine mammals can provide evidence for their direct economic value, in the form of jobs and income from tourism, and indirect benefits from ecosystem services, can provide managers and other decision-makers with a holistic understanding of the complex nexus between ecological, economic and social ecosystem values [3].

Socio-economic variables

When an MPA is planned, or when significant modifications to management are planned (such as zoning or fishing regulations), details of activities data such as shipping traffic, commercial fishing data, catch data, whale-watching and recreational fishing can better inform decision-makers of the costs and benefits of management decisions. This may involve the costs that arise from, for example, commercial fishing restrictions. Likewise, the benefits to industries such as tourism are able to be quantified.

Socio-economic data can also provide detailed spatio-temporal information about potential impacts of activities within the MPA. In the case of commercial net fishing, for example, this data can quantify what locations are subject to high or low impact at different times. Adaptive management of MPAs for the conservation of marine mammals can benefit from updated monitoring data (e.g. shipping traffic, commercial, artisanal or recreational fishing pressure etc.), the trends in these uses, and the effects of management actions on these threats [4].

Scientific research should be monitored. The number of projects (particularly specific to marine mammals), the MPA budget for research, the extent of external funding, and its sources, are important factors to consider when developing or reflecting on the research and monitoring strategy in the MPA [4].

Given the social, cultural, and traditional values, as well as economic values, placed upon marine mammals, and the areas in which they inhabit, socio-economic monitoring should also consider the potential impact of any management on actors, communities and relevant sectors. Where management may influence core values of stakeholders with high levels of dependency, alongside transparent planning processes, regular socioeconomic data collection should be implemented which commonly includes stakeholder interviews. Such variables to collect value data include age, gender, education, household income (derived from activities potentially impacted by management plans), usage patterns, level of MPA knowledge, management priorities and livelihood dependency. It is important to recognise that each community or set of actors will have specific needs and interests, and therefore the monitoring programme should aim to obtain a holistic representation.

Case study

The value of whale watching worldwide

Connor (2009) published an extensive report in 2009 funded by the International Fund for Animal welfare about the economic value of whale watching worldwide. In 2008, 13 million people participated in whale watching in 119 countries and territories, generating total expenditure of $2.1 billion. Furthermore, an estimated 3,300 operators offer whale watching trips around the world. The operators employ an estimated 13,200 people. Across the globe, the whale watching industry has grown at an average rate of 3.7% per year, comparing well against global tourism growth of 4.2% per year over the same period.

Read more in Whale Watching Worldwide

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Resources & references

Additional resources

- *PDF: O'Connor, S., Campbell, R., Cortez, H., & Knowles, T., 2009, Whale Watching Worldwide: tourism numbers, expenditures and expanding economic benefits, a special report from the International Fund for Animal Welfare, Yarmouth MA, USA, prepared by Economists at Large.*
- *PDF: Rögnvaldsdóttir, R (2016). Economic Effects of Tourism in Þingeyjarsýslur Analysis at the sub-national level in Iceland*

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2. *Marine Mammal Commission: The Value of Marine Mammals*
3. *Pomeroy R.S., Parks J.E., Watson L.M. 2004. How is your MPA doing? A guidebook of natural and social indicators for evaluating marine protected area management effectiveness. IUCN, Gland, Switzerland and Cambridge, UK. 234 pp*

Marine Mammal research/ scientific permits/ agreements

Research and monitoring

The importance of marine mammal research in MPAs

Research should seek to improve the understanding of the ecological and socio-ecological functioning of the MPA [1]. Marine mammals, in particular, are often very difficult to study, resulting in gaps in our knowledge of their status, ecology and vulnerability to threats. Research, therefore, plays a valuable role in filling these knowledge gaps and informing MPA management in ways to mitigate threats and meet the purposes of the MPA.

MPAs can provide important and unique research opportunities because by design they are often less impacted by anthropogenic activities. Often, the most pristine and important remaining area for some species. Some factors can be better controlled within an MPA (ie. fishing-free zones). Allowing research within an MPA also allows MPA managers to assess the performance of the MPA [2].

Responders collect biological samples from a dead common bottlenose dolphin that stranded in Florida. © Hubbs-SeaWorld Research Institute / NOAA.

Research prioritisation within an MPA

Large knowledge gaps will usually exist in relation to the conservation of marine mammals in an MPA, ranging from habitat usage, population trends, the impact of human activities in the MPA, to the economic impacts of management decisions on users, and many more. Full establishment of research in order to fill all knowledge gaps is impossible. Therefore, MPA management should conduct or promote research that is most urgent or critical to achieving the objectives of the MPA [1].

Research permitting systems for an MPA

A research permitting system is essentially a formal application process for research. It will often be administered by a government agency, but when the research is to be conducted within an MPA, it may be assessed by MPA management. The permit application allows management to ensure that research conducted in the MPA is to the benefit of the MPA and its management goals.

Some research activities may have intended or unintended impacts on marine mammals or their habitats. Therefore, MPA managers can weigh up the possible ecological cost vs the benefits of the proposed research.

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Some factors that may be considered include:

- whether a project needs to be conducted within the MPA;
- the potential ecological impacts of the proposed project;
- the assessment of the cumulative impacts on species and their habitats by the proposed project and any other on-going projects [3];
- whether the research methodology could be modified in order to reduce the risk of impacts to the environment;
- the value of the research to the management goals of the MPA.

The research permitting system also allows MPA management to easily catalogue current and previous research in the MPA in order to evaluate as well as guide research within the MPA. Marine mammal research activities and partnerships can more easily be publicised and justified in publicly available documents.

Case study

Great Barrier Reef Marine Park Authority (Australia)

The Great Barrier Reef is, unsurprisingly, the focus of much research, including into marine mammal ecology and the processes that threaten them. The agency formally sets out its research priorities every five years, incorporating a range of criteria, and engages with researchers from different organisations through a series of long-term formal relationships. Research permits are jointly issued by the agency and the Queensland Parks and Wildlife Service, and the assessment process is open and transparent.

Great Barrier Reef Marine Park Authority Science Strategy and Information Needs 2014-2019, GBRMPA, Townsville
Research Permit Guidelines

Resources & references

Additional resources

- *Using Important Marine Mammal Areas (IMMAs) as a tool for awareness and protection*
- *Papastavrou, V., & Ryan, C. (2023). Ethical standards for research on marine mammals. Research Ethics, 0(0)*
- *JNCC (2005) Common Standards Monitoring Guidance for Marine Mammals, JNCC, Peterborough, ISSN 1743-8160*

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3. *Ocean Science Trust: A Framework for Informing Permitting Decisions on Scientific Activities in Marine Protected Areas*
4. *Marine Mammal Protected Areas Taskforce – Important Marine Mammal Areas*

Outreach and engagement

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Involvement of stakeholders and other partners in marine mammal management

Outreach and engagement

Introduction

Almost all MPAs combine biodiversity conservation (including the protection of marine mammals) with other activities that rely on the marine environment and/or its natural resources. Local non-commercial stakeholders include local communities, recreational fishers, traditional owners, and non- governmental organisations. Commercial stakeholders might include commercial fishers, tourism, shipping and port operators, the military, and the aquaculture and renewable energy sectors.

MPAs rarely succeed without significant involvement of stakeholders, and the sharing of benefits from the MPA. Therefore, MPA stakeholders should be involved in the planning stages of an MPA through to ongoing management [1].

Benefits of stakeholder engagement in marine mammal management

Many stakeholders, such as fishers, traditional owners, and tourism operators, bring substantial local knowledge relevant to marine mammals to MPA planning and management.

The goodwill and sense of custodianship of the MPA on the part of stakeholders can lead to many benefits. In the case of commercial stakeholders, this might include a greater commitment to the implementation of joint decisions and increased voluntary compliance (such as adhering to zoning and gear regulations, speed limits or whale-watching guidelines). Increased compliance can therefore lead to cost savings in enforcement. Problems and disputes are less likely (although can still occur) due to all parties understanding the positions of other stakeholders [1]. Transparent and participatory processes during the development and establishment of MPAs and respective management plans can empower stakeholders to adopt, manage and be involved in future development to enable adaptative management.

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The agency and local stakeholders such as fishers, tourism operators, or local communities may join forces to protect the MPA from possibly more destructive activities such as mining or oil exploration, or collectively lobby for coastal water-quality policies [2]. Non-government conservation organisations can bring funding, expertise and outreach skills to an MPA. Engagement with the tourism industry is of particular importance in order to minimise impacts, raise awareness and participate in the ongoing monitoring of marine mammals (allowing adaptive management) [3]. Effective and well-managed eco-tourism initiatives can generate sustainable funding mechanisms to further support the MPA.

The connections formed by these forms of engagement benefits (and provides a further conduit to) education and awareness-raising campaigns (see Section 19).

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Marine mammal regional agreements, networks, and action plans

Many marine mammals can migrate or range beyond national jurisdictions. Therefore, regional agreements such as ASCOBANS can promote cooperation between nations within a region that share marine mammal populations. Sharing of knowledge and data, the creation of local and regional management plans, and compulsory legislative measures may all form a part of regional agreements [4].

Many MPAs are very small, whereas many marine mammal species, and particularly cetaceans, range widely or migrate. Therefore, MPA networks, which include multiple MPAs that interact in a meaningful manner, may more appropriately represent the areas required during the life history of many marine mammals [5].

Case study

Representative Areas Program. Great Barrier Reef (Australia)

In response to the recognition that biodiversity protection in the Great barrier Reef was inadequate, the entire Marine Park (344,400 km2) was re-zoned in 2004. In the process, no-take zones increased from < 5% to more than 33%.

The management agency (GBRMPA) undertook a multi-phase formal public participation process, using a variety of techniques. The process reached out to local communities, commercial and recreational fishing organizations, key federal and state politicians, Indigenous people, tourism operators and conservation groups. The process included meetings, public information sessions, a submission process, and substantial advertising.

The second formal phase occurred after the publishing of the draft re-zoning plan and sought feedback from stakeholders. The final zoning plan (differing from the draft plan) was developed from a combination of science and real stakeholder involvement.

Day, Jon C. (2017) Effective public participation is fundamental for marine conservation-lessons from a large-scale MPA. Coastal Management, 45 (6). pp. 470-486.

Resources & references

References

1. *MPA networks*
2. *Great Barrier Reef: tourism operators urge Australian government to tackle climate change: The Guardian, 7 May 2017*
3. *IWC: Stakeholder engagement and adaptive management.*
4. *Convention on the Conservation of Migratory Species of Wild Animals*
5. *Hoyt, E. (2011). Marine Protected Areas for Whales, Dolphins and Porpoises: A World Handbook for Cetacean Habitat Conservation and Planning. Routledge, 2011.*

Communication, Education & Public Awareness

Outreach and engagement

Why is education, communication and awareness raising important?

Communication, Education and Public Awareness (CEPA) are important instruments for the conservation and sustainable use of biodiversity. CEPA provides the crucial link from science and ecology to people's social and economic realities. It supplies the oil for the implementation of the Convention on Biological Diversity and deals with the processes that motivate and mobilise individual and collective action. It comprises a range of social instruments including information exchanges, dialogue, education, and marketing.

In most cases, it is not sufficient to simply inform people about biodiversity, marine mammals, or individual species so that they can correct or improve their behaviour and actions. Such changes are not born from rational individual choice alone. Therefore, marine mammal or MPA managers must consider differing approaches of utilising communication, education, and public awareness beyond utilising it is a mechanism to simply make scientific information available to the wider public.

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In a study published in 2010, it was discovered that the general public did not hold a great understanding on the importance of charismatic megafauna [1]. As a result of this limited understanding potential harmful behaviours towards cetaceans could arise. Harmful activities could include approaching wild cetaceans in a potentially detrimental manner (approaching too quickly, within unfavourable proximity), attempting to touch them and/or possibly attempting to feed them.

In this light, CEPA can ultimately be utilised by managers to not only highlight underlying and direct causes of impact to target species and populations, within and adjacent to the MPA, but also as a tool to reduce, or limit, the impact of such causes. Moreover, CEPA can be deployed to empower stakeholders and increase buy-in through participatory planning processes when developing management plans for MPAs, or marine mammal species. This, for example, could reduce the highlighted impact of *entanglement* or *bycatch* via tools to raise awareness amongst fisherfolk, tools to evoke active responses and inputs into the generation of

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new management plans, and tools for communication between the formal components of the management plan's development. All the tools available through CEPA contribute to the success of the respective management plan, while reducing identified impacts, that go beyond simply making scientific information available.

Further tools could include Mobile awareness programmes (e.g., talks, workshops), Printed materials, Video/Documentaries, Performing arts, and Exhibitions.

Resources & references

Additional resources

- *WWF Whales and Dolphins*
- *Toolkit: Communication, education and public awareness (CEPA): a toolkit for national focal points and NBSAP coordinators*
- *Convention on Biological Diversity: Section 1: Why do we need CEPA and how to start?*
- *Report of the Third South-east Asian Marine Mammal Symposium (SEAMAM III): Workshop on Communication, Education and Public Awareness (CEPA) (page 222)*

References

1. *Assessing Knowledge, Attitudes, and Behaviour Toward Charismatic Megafauna: The Case of Dolphins*
2. *Scotland's first MPA visitor centre*

Good practices

- *Whale SENSE: Consumer Choices Matter*

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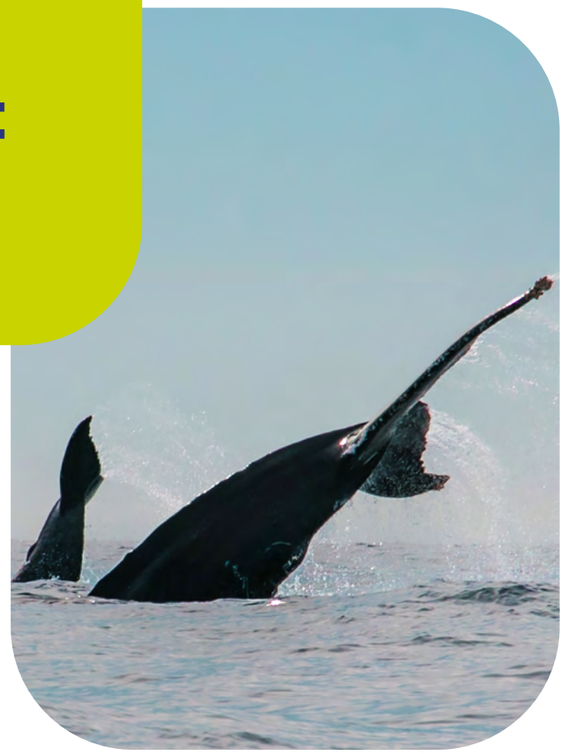
Management effectiveness

Compliance and Enforcement

Management effectiveness



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Introduction

A common cause of marine protected areas failing to meet their objectives is due to a lack of user compliance with rules and regulations within the MPA. The reasons for a lack of compliance can be varied, including poor engagement of MPA users during the planning process (*see Factsheet 18*), a lack of information regarding patterns of use within the MPA (*see Factsheet 16*) poor enforcement capacity (and/or political will), or due to logistical issues related to the location of the MPA [1].

Therefore, MPA compliance is not just related to enforcement, although enforcement is an important tool. Other tools include education, stakeholder engagement, seeking to understand user behaviour, and surveillance, with enforcement and prosecution as last resorts [2]. Understanding the motivations behind non-compliance can help to determine the most appropriate tools to use [3].

Education and Information

Compliance programmes based on education and public awareness, such as CEPA, are far cheaper than those based on enforcement [4]. These may include stakeholder engagement (at all stages of MPA planning and management), and prominent display of information outlining regulations and their rationale (and penalties for breaches) online and at sites such as boat ramps. An effective education programme, as well as promoting MPAs and aiding in their planning, is an important part of compliance [5].

Coordination with other agencies

On-water enforcement is frequently performed by other agencies, such as the Coastguard (in the U.S.) or national parks agencies (in Australia). Where this is the case, formal enforcement agreements between the MPA management and the other enforcement agency can provide for effective cooperation.

Patrol capacity

Patrol capacity essentially involves the capacity to perform surveillance in order to check for compliance. There exist a range of surveillance strategies depending on the particular MPA setting, the types of regulation breaches that are likely to occur, and available resources and expertise. Vessels and staffing invariably form a component of this capacity, while capacity for aerial surveillance, vessel tracking, and checks of fishing catch may also form a component of the mix.

Penalties and their imposition

Penalties for breaches of MPA regulations need to be sufficiently large to provide a deterrence and be rigorously applied. Compliance in many MPAs, however, suffers from a lack of political will to impose sanctions for MPA regulation breaches, or from corruption [6].

Case study

Education, Surveillance and Enforcement of Zoning: Great Barrier Reef (Australia)

Covering 344,400 km2, zoning compliance and enforcement on the Great Barrier Reef involves a diverse range of tools. Education and public outreach include the distribution of free zoning maps, signage at boat ramps, electronic maps for GPS, news releases, media interviews, advertising, and billboards.

urveillance includes regular boat and aircraft patrols, which are conducted in collaboration with a range of State and Federal agencies. The Great Barrier Reef Marine Park Authority contains a dedicated compliance unit, which collaborates with agencies responsible for parks and wildlife, boating and fishing, customs, maritime safety, and police services.

The authority also encourages all users of the Marine Park (recreational and commercial) to report suspected illegal activities, thus forming an extra source of surveillance information for the managing agencies.

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Resources & references

Additional resources

- *NOAA Marine Mammal Protection*
- *IWC Handbook[whale watching]: Monitoring and Enforcement*

References

1. *Agardy, T., Notarbartolo di Sciara, G., Christie, P. (2011) Mind the gap: addressing the shortcomings of marine protected areas through large scale marine spatial planning. Marine Policy 35:226-232*
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Reporting / Reviewing management effectiveness

Management effectiveness

Introduction

An MPA management plan (or plans) should not only explicitly detail the various management strategies that are, or will be, implemented in order to reach the goals of the MPA, but should contain objectives and indicators that are Specific, Measurable, Attainable, Relevant and Time-bound (SMART) using an appropriate monitoring programme [1].

The extent to which the MPA is meeting its goals should be defined by the management plan's indicators and objectives. These should be regularly reviewed with management practices revised and adapted as needed based on by the results of monitoring. Reviews of management effectiveness is therefore integral to adaptive management [2].

However, simple biological measures (e.g., abundances of focal marine mammal species) that reflect the delivery of protected area goals are just one dimension of a review of management effectiveness. Management effectiveness may also refer to the adequacy and appropriateness of chosen management systems and processes in place, (the overall focus of the Marine Mammal Management Self-Assessment Tool) as well as the delivery of these management systems and processes [3].

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Reviewing the effectiveness of marine mammal management

Ideally, an MPA should have conservation or recovery plans for marine mammal species. However, due to a range of factors, such as a species' range or movement patterns, or a lack of available knowledge, many marine mammal species are instead subject to conservation (or recovery) plans at the national or regional levels or not at all.

Within MPAs, however, specific attention may be given to 'focal' marine mammal species, which includes species that are endemic, flagship, indicator, of economic value (such as for whale watching) or vulnerable. In these cases, MPA-specific vulnerability assessments or summaries of management actions that relate to a species (e.g. the Indo-Pacific humpback and Australian snubfin dolphins in the Great Barrier Reef Marine Park) may be produced [4].

Regardless of whether there exist MPA-specific conservation plans for marine mammal species in the MPA, focal species of marine mammal should, if possible, be monitored (see Factsheet 13) and trends over time can be analysed with respect to the overall goals of the MPA [1].

Main management effectiveness evaluation tools

Year	Organisation	Tool name
2017	UICN	Green List of Protected and Conserved Areas: Standard, Version 1.1
2015	BIOPAMA / European Commission	Integrated Management Effectiveness Tool (IMET)
2008	UICN	Evaluating Effectiveness: A Framework for Assessing Management of Protected Areas (2nd edition)
2008	UNESCO	Enhancing our Heritage (EoH) Toolkit Assessing management effectiveness of natural World Heritage sites
2007	WWF-World Bank	Management Effectiveness Tracking Tool (METT) – Reporting Progress at Protected Area Sites: Second Edition
2004	World Bank	Score Card to Assess Progress in Achieving Management Effectiveness Goals for Marine Protected Areas – Revised version
2004	UICN	How is your MPA doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness
2003	WWF	Rapid Assessment and Prioritization of Protected Area Management Methodology (RAPPAM)
2003	World Bank	Score Card to Assess Progress in Achieving Management Effectiveness Goals for Marine Protected Areas
2003	WWF- World Bank	Management Effectiveness Tracking Tool (METT) – Reporting Progress at Protected Area Sites
2000	UICN	Evaluating Effectiveness: A Framework for Assessing Management of Protected Areas (First edition)

Resources & references

Additional resources

- *IUCN WCPA Management Effectiveness*
- *Protected Areas Management Effectiveness Methodologies*

References

1. *Evaluating Effectiveness A framework for assessing management effectiveness of protected areas 2nd Edition*
2. *Convention on Biological Diversity – Protected Areas Management Effectiveness*
3. *Protected Areas Management Effectiveness (PAME)*
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Overall management capacity across all operations affecting marine mammal conservation

Management effectiveness

Introduction

Most MPAs report a shortfall in their capacity to manage operations. A 2017 survey of 433 marine protected areas found that 65% reported shortfalls in funding for basic management, while 91% reported inadequate or below optimum staff capacity (capacity/numbers). Further, the study found a relationship between budget and staffing capacity with conservation impact (measured by fish populations) [1]. In other words, generally-speaking, management capacity in the form of budgets and staffing is important to the goals of an MPA, and there is no reason to think that this relationship would not also apply to marine mammal conservation in the MPA.

This section focuses on the capacity of the MPA to manage the operations that directly or indirectly affect marine mammal conservation, as outlined in previous factsheets. In many cases, collaborating organisations or other government agencies fulfilling some of the management operations (such as monitoring or enforcement) [2].

Overall budget

The overall budget for activities affecting marine mammal conservation would include budget allocations that are or would be spent on most of the areas covered in earlier factsheets. The overall budget should be all encompassing and account for all the actionable and foreseeable activities.

Human resources

This is related to the number of available staff, and the staff skill set for the various activities related to marine mammal management. The budget should give due consideration to the amount of time required by each staff and account for any additional costs in relation to staffing such as training.

Overheads & Hardware

Administration facilities in the form of office and computing assets are vital to MPA management, as is field equipment where required (although this would depend on how much of the on-water activities are performed by other agencies or partner organisations). Furthermore, overheads must be considered within budgets. There is no standardised measure of determining the percentage cost of overheads against the overall budget so a full financial mapping of the MPA is advised.

Planning for the future

Formal assessments of current capacity and shortfalls in capacity, as well as future requirements, can guide planning with respect to future funding, and help direct management toward critical partnerships and collaboration.

Resources & references

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Resource Allocation to Research, Monitoring and Enforcement

Management effectiveness

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Introduction

In some cases, the available data and information on the targeted marine mammals in which the MPA is aiming to conserve and manage can be limited. This includes the ecology and the threats that they are subjected to. As such, further research, as well as monitoring, should be conducted or encouraged by MPA managers [1]. However, marine mammal research and monitoring is often difficult and expensive, requiring considerable resources and expertise.

This factsheet focuses on the overall capacity to perform research and monitoring of marine mammals within the MPA. In many cases, collaborating organisations or other government agencies fulfil some of the management operations (such as monitoring or enforcement) [2]. In these cases, consideration to the allocation of resources and when assessing capacity should also be given to these partner organisations including research groups in addition to the MPA management agency.

Overall budget

The adequacy of the budget allocated to research and monitoring must be considered in the context of how much research and monitoring is expected from (or left to) MPA management, depending on what agreements are in place with other agencies or research organisations in order to 'outsource' these tasks. It is important that these amounts, accompanied by specific activities and the organisation responsible, are defined in any agreements and/or contracts.

Equipment and hardware

Similarly, the overall budget, equipment and hardware is dependent on the specific research and monitoring arrangements for the MPA. For example, the use of hydrophones for monitoring cetaceans and other underwater noise would, in many MPAs, be undertaken by researchers from other organisations in collaboration with the MPA management unit. Where this the case, then the capacity of outside collaborators would need to be considered when allocating and accounting for resources.

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Resources & references

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2. *Blue Marine Foundation: How do we pay to protect the ocean?*

Marine mammals management toolkit

www.marine-mammals.info

EU-funded Ocean Governance Project

Ocean Governance

Protecting and restoring marine ecosystems as catalysts for building peace and security and fostering sustainable economies in South-East Asia and the Atlantic Ocean basin.

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The project is being implemented by a consortium of partners including *GOPA International Consultants*, *B&S Europe* and *WWF Indonesia*.

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This project is funded by the European Union