REPORT OF THE ASCOBANS WORKSHOP
TO RECOMMEND SMALL CETACEAN CONSERVATION OBJECTIVES IN RELATION TO ANTHROPOGENIC REMOVALS
– PART 1

Online

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Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas

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Executive Summary

The aim of ASCOBANS is "to achieve and maintain a favourable conservation status for small cetaceans" in the Agreement area. The definition of favourable is set out in Article 1 of the Convention on Migratory Species and the aim to achieve and maintain a favourable status was interpreted as "to restore and/or maintain biological or management stocks of small cetaceans at the level they would reach when there is the lowest possible anthropogenic influence' (Res.3.3)". A short-term sub-objective at the time was "to restore and/or maintain biological or management units to/at 80% or more of the carrying capacity" (Res.3.3, Res. 8.5 (Rev. MOP9)).

With regards to the objective to restore/maintain management units/populations at 80% of carrying capacity, there is a lower bound in the conservation objective (i.e., 80% of carrying capacity), but there is no time horizon (i.e. period over which to achieve the objective) nor a probability (i.e., confidence/risk level) associated with that figure. The *Workshop to recommend small cetacean conservation objectives in relation to anthropogenic removals – Part 1* aimed to propose an agreed usable quantitative conservation objective (e.g. restoring to and/or maintaining the population at or above a certain percentage of carrying capacity for a certain percentage of cases within a temporal window of x years), and a recommended approach to setting appropriate thresholds .

The workshop included extensive discussion on the specificity required in a conservation objective including actual, theoretical, and historical carrying capacity, time frames, probability, and the interplay with other anthropogenic threats and environmental stochasticity. The importance of the spatial element of management was also highlighted. Several data sources and operating models were considered.

Participants discussed the approach taken in the US, noting that the US Marine Mammal Protection Act (MMPA) specifies that marine mammal populations should be at their Optimum Sustainable Population which is legally defined as between their maximum net productivity level (MNPL) and carrying capacity. MNPL is currently estimated to be 50% of carrying capacity (K), thus the objective is that a population should recover to or be maintained at or above 50% of carrying capacity, with a 0.95 probability (confidence level) over a 100-year time horizon

Participants also discussed work undertaken in Europe including by OSPAR's Marine Mammal Expert Group which employed a quantitative interpretation of the ASCOBANS conservation objective that is: "a population should [be able to] recover to or be maintained at 80% of carrying capacity, with 0.8 probability, within a 100-year period". This approach has also been adopted by the Helsinki Commission's (HELCOM) Marine Mammal Expert Group.

Participants emphasised the importance of having an agreed conservation target that is sufficiently detailed to ensure the delivery of management action to reduce bycatch where an issue has been identified. The rationale for the conservation objective should be clearly communicated.

A number of general points were made:

- The ASCOBANS Conservation Objective should remain to restore and/or maintain biological populations / management units at or above 80% of carrying capacity (K), but some justification for the lower bound that may be considered acceptable is needed so that it is not viewed as an entirely arbitrary value;
- It might be worth considering more than one option for an appropriate time horizon, and to review further the probability value of 80% vs 95% for Part 2 of the workshop;
- The application of the conservation objective should be at least as stringent as is required by the US MMPA;
- The conservation objective should be implemented using a range of tools (e.g. Potential Biological Removals, PBR; Removals Limit Algorithm, RLA; Population Viability Analysis, PVA) depending upon the amount of data available for the species /population/ management unit in question.

1 Introduction

The *workshop to recommend small cetacean conservation objectives in relation to anthropogenic removals – Part 1* aimed to reach an agreed usable quantitative conservation objective and a recommended approach to setting thresholds appropriate to different small cetacean species, that is both precautionary and practical.

The workshop was a small technical (online) session primarily comprising experts who have been directly involved in defining conservation objectives in relation to bycatch and setting thresholds.

1.1 Welcoming Remarks

Peter Evans, Co-Chair of the ASCOBANS-ACCOBAMS Joint Bycatch Working Group (JBWG), welcomed everyone and drew attention to the agenda which had been circulated by email (Annex 1). He highlighted the extensive expertise of workshop participants, with many involved in key global work over many years.

A document containing discussion points was circulated by email and participants were invited to add any additional points.

1.2 Participants

The list of participants is available in Annex 2. Apologies were received from Greg Donovan, Andre Punt, and Kate Searle.

1.3 Key Definitions

The workshop considered a range of scientific issues, with a number of very specific terms used. Several of these relate to the use of PBR as developed in the US in the context of the Marine Mammal Protection Act.

2 Presentations

A number of presentations were given, the contents of which are summarised below. The extended discussions following the presentations will be summarised in Section 3.

2.1 ASCOBANS Conservation Objectives

Sinéad Murphy introduced discussions within ASCOBANS on previous Conservation Objectives, drawing attention to ASCOBANS Resolution 3.3 on Incidental Take of Small Cetaceans adopted in 2000 and Resolution 5.5 on Incidental Take of Small Cetaceans one in 2006, both of which are still extant but needed revisiting. These Resolutions set out the key conclusions in the process around conservation objectives and the setting of bycatch limits, and Resolution 8.5 (Rev.MOP9) in 2020 which provided further clarification to some of those conclusions.

The aim of ASCOBANS is “to achieve and maintain a favourable conservation status for small cetaceans in the Agreement area”. The definition of favourable is set out in Article 1 of the Convention on Migratory Species. Ms Murphy explained that in ASCOBANS, the aim to achieve and maintain a favourable status was interpreted as “to restore and/or maintain biological or management stocks of small cetaceans at the level they would reach when there is the lowest possible anthropogenic influence’ (Res.3.3)” and a short term sub-objective “to restore and/or maintain biological or management units to/at 80% or more of the carrying capacity” (Res.3.3, Res. 8.5). Ms Murphy noted that ASCOBANS no longer employs the term ‘stock’.

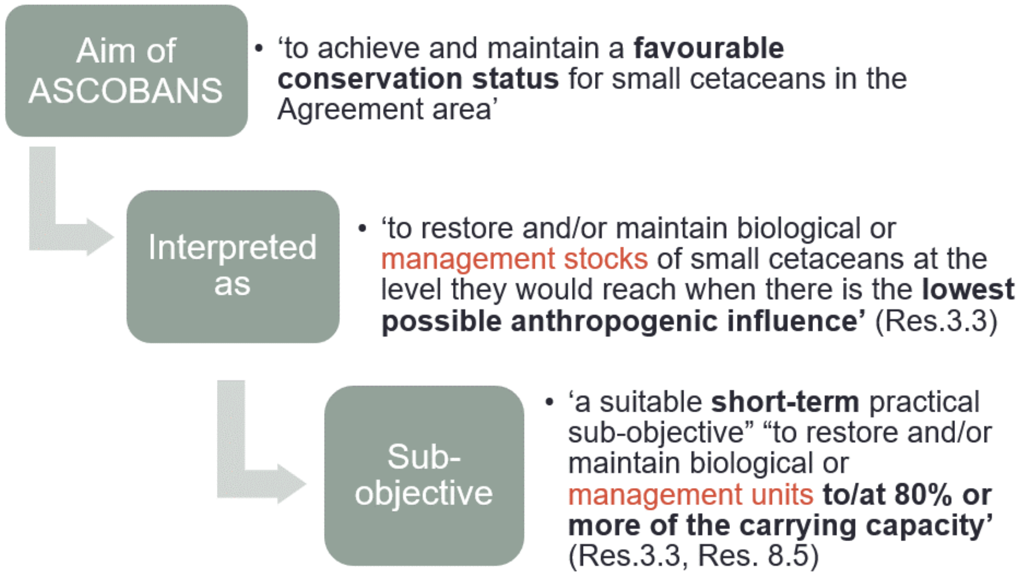

Figure 1: Slide from Ms Murphy's presentation

The level 80% of carrying capacity (K) was chosen after taking into account information for other species (including the International Whaling Commission's Revised Management Procedure) which indicated that this is generally above the level of maximum productivity and therefore more appropriate for a conservation agreement (Reijnders, Inf06_MOP2_Doc.4., 1997). ASCOBANS recognised that it was difficult, and perhaps impossible, to determine a level of abundance that represented carrying capacity, but hoped that having a theoretical target level would allow the development of a longer-term approach.

In addition, ASCOBANS Resolutions 3.3, 5.5 and 8.5 have a longer-term aim "to minimise (i.e. ultimately reduce to zero) anthropogenic removals (i.e. mortality)" although no time frame was specified, and a short-term intermediate precautionary objective outlined in Resolutions 3.3 and 5.5 was "to reduce by-catches to less than 1% of the best available population estimate."

Ms Murphy noted that the term 'Unacceptable Interactions' is used throughout ASCOBANS. An unacceptable interaction was considered to be "a total bycatch level in all fisheries above 2% of the maximum likelihood estimate of abundance within an appropriately defined management region". During a meeting in 1999, the joint working group on Harbour Porpoise of the International Whaling Commission (IWC), in the context of the ASCOBANS conservation objective (to restore populations to, or maintain them at, 80% or more of K), determined a threshold of 1.7% of population size in that year, as a more precautionary percentage for unacceptable interactions. The limit of 1.7% was derived using a simple deterministic population dynamics model to achieve 80% of K over an infinite time horizon. The probability (i.e. % of cases) was not stipulated, at least not within the IWC-ASCOBANS working group report. Other criteria employed included an R_{max} of 4%, selected to mirror the default value in the US PBR framework. The model did not include any life history data on the harbour porpoise; it assumed a single stock with more or less independent dynamics (when this is not the case the limit is liable to be inappropriate). Further, the model did not incorporate uncertainty in estimates for any parameter (e.g. population size). If such uncertainties are to be considered, then the maximum annual bycatch must be less than 1.7% to ensure a high probability (i.e. 80% or 95%) of meeting the ASCOBANS objective. Meeting the objective in a shorter timeframe would require that annual bycatch to be reduced to an even lower fraction of the abundance.

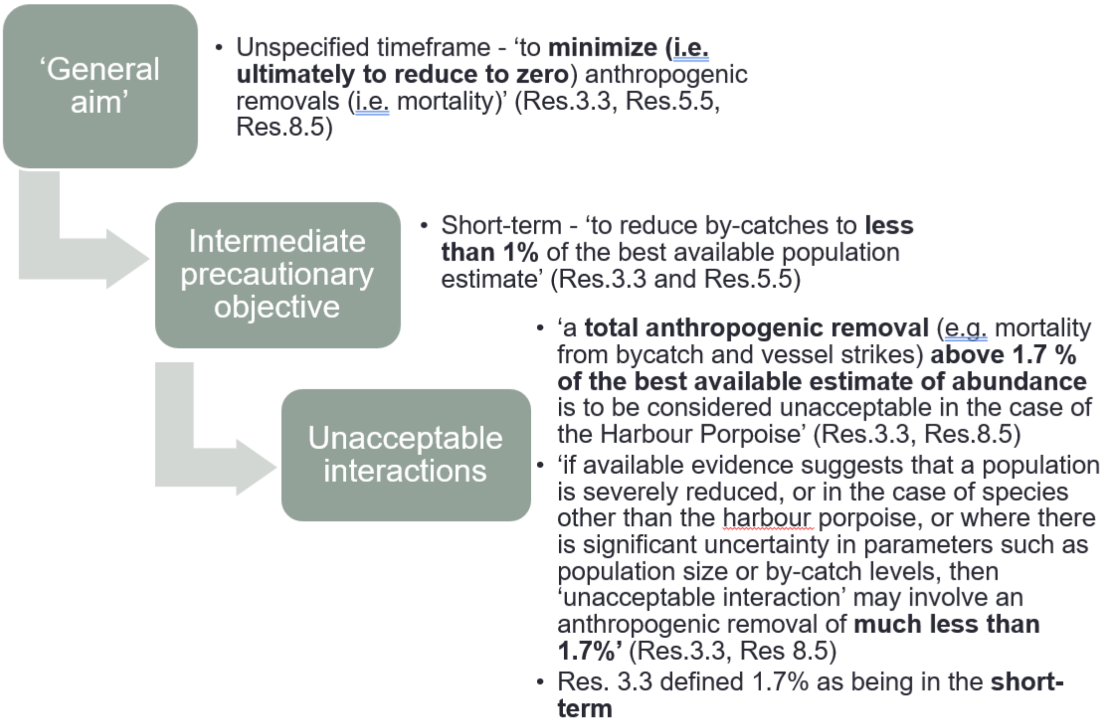

Figure 2: Slide from Ms Murphy's presentation.

In 2015, ASCOBANS held a workshop on 'Unacceptable Interactions Part 1', which involved a range of stakeholders including scientists, policy makers, non-governmental organisations etc. At that workshop, rather than using thresholds, it was broadly agreed that the term 'environmental limit' could be used to indicate a "critical" or "unacceptable" point in the environment that should not be exceeded. Further, in the 2015 workshop it was noted that the term 'trigger' could be employed to signal the need for different types of management action that may need to be taken before an 'environmental limit' is reached i.e. 'triggering' urgent action when approaching an 'environmental limit', or 'triggering' the re-allocation of some resources to more urgent areas once bycatch drops below a certain point. These terms, and others, required further defining for agreement and use within ASCOBANS (incl. unacceptable interactions, targets, sustainable removal, thresholds).

It was noted in the 2015 workshop (and the current workshop) that the Conservation Objective at/to 80% of carrying capacity represented the only widely recognised and accepted figure currently used across Europe. Careful consideration should therefore be given before changing something that already had significant political and societal acceptance within the EU, NGOs and other stakeholders.

Using the North-east Atlantic common dolphin as an example, Ms Murphy presented results of employing ASCOBANS 1% and 1.7%, as well the US PBR, US 10% of PBR (zero mortality rate goal) and OSPAR's mPBR, to highlight how cautious other objectives were compared to using a 'generic' bycatch figure such as 1% or1.7%.

Discussion

It was also noted in the discussions following the presentation, that it would be useful for the terminology used within ASCOBANS and the terminology used in other relevant regional conventions and Directives to be harmonised. There was no consensus on this view. For example, the Commission Decision ((EU) 2017/848) related to the Marine Strategy Framework Directive (2008/56/EC) states that "Member States shall establish the threshold values for the mortality rate from incidental by-catch per species, through regional or subregional cooperation". This cooperation occurs under HELCOM and OSPAR, both of which employ the use of the term “threshold” when assessing developed indicators. Further discussion on the points raised are summarised in section 3.1 *Conservation Objectives*.

2.2 Introduction to genetic methods on estimating population size and identifying management units

Rus Hoelzel introduced two topics: the first on how genetic methods could be used to estimate population size (instead of or in addition to census methods), particularly historical estimates given that current population sizes and the first available abundance estimates may already have been depleted; and the second on how genetic methods can support the identification of management units.

He explained the concept of effective population size (Ne), which is the size of an idealised population that shows the same rate of loss of diversity as the real population. He noted that the rate at which diversity is lost is affected by factors such as the number of effective breeders, demographic history, etc.

Mr Hoelzel referred to meta-analysis (Frankham, 1995) which showed a ratio of **Ne/Nc**[1] = ~0.11, although the variation was great. He noted that there are various ways to estimate effective population size. One of these, the Linkage Disequilibrium (LD) method, can provide an estimate of contemporary Ne. He noted that the process is about drift causing associations among loci and assumes no physical linkage, though this can be corrected for. Two example programs using this method, SNEP and GONE, estimate Nt (Ne t generations in the past), with resolution back approximately 100-200 generations.

On management units, Mr Hoelzel recalled the ASCOBANS (2009) definition of a Management Unit (MUs) as “a group of individuals for which there are different lines of complementary evidence (e.g. morphometrics, life history parameters, photo-ID, in addition to genetics) suggesting reduced exchange (migration / dispersal) rates over an extended period (low tens of years)”. A previous, definition based solely on genetics (Moritz 1994) was that: “MUs are therefore recognized as populations with significant divergence of allele frequencies at nuclear or mitochondrial loci, regardless of the phylogenetic distinctiveness of the alleles.” Separately, an Evolutionarily Significant Unit (**ESU**) was defined at a meeting of the American Association of Zoological Parks and Aquariums, where it was agreed an ESU should be based on concordant evidence from e.g. morphology and genetics (Ryder 1986). The ESU concept was tied to the US Endangered Species Act in 1991, recognising that an ESU should 1) be substantially reproductively isolated from other conspecific population units, and 2) represent an important component in the evolutionary legacy of the species. (Waples 1991).

An ESU was considered a ‘stricter’ concept than an MU, which allowed more connectivity between populations. Around 2000, there was consensus that molecular genetic evidence and phenotypic (adaptive) variation should be considered as part of a whole species concept, and an ESU assigned as appropriate.

Mr Hoelzel summarised work looking at the impact of isolation on genetic drift among populations (both modelling and empirical data), and modelling using harvested populations and non-harvested populations. He noted that theoretically only 1 migrant per generation could result in panmixia (no genetic differentiation within the population/management unit), but that real populations can be differentiated with higher levels of gene flow. He also emphasised that populations that are demographically distinct (i.e. pertaining to processes that affect the size of a population (e.g. birth, death, dispersal) might not be genetically distinct.

[1] *N*c, the adult census population size, is generally defined as the total number of potential (sexually mature) breeders, sometimes assessed by directly counting individuals.

Discussion

It was noted that Effective Population Size (Ne) and Management Units should not be viewed separately. Isolated populations with small Ne will drift apart and become more differentiated more quickly by drift than when Ne is large.

Mr Evans explained that the EU recently sought to "define and apply the concept of Favourable Reference Values" to the Habitats Directive, both for populations and for distribution ranges (see Biljsma et al., 2018). This was a way to account for the fact that in many places, populations have been depleted below K. He suggested that effective population size (Ne) might be a way to determine the reference population going back a few generations rather than using the current population census size; this would be dependent upon the time span required and various other factors that might influence carrying capacity.

Paul Wade noted that, in the USA, the Potential Biological Removal approach is modelled using some estimate of the current carrying capacity (K), and he didn't believe that a genetically estimated population size would be used for that, particularly if the timescale is going back more than a few 100 years. Nonetheless, he noted that if human impacts had reduced current carrying capacity over the last few generations, it could be useful to explore the possibilities of these data.

Justin Cooke noted that when discussing 80% of K, there is a modest difference in population size between the target for the fished and the unfished populations. Given that the range of uncertainty is much bigger for estimates of historical population size, it was not meaningful to choose a number based on a genetic Ne, and then aim for a population 80% of that. He suggested that while the genetics give a ballpark idea whether a species was common in the past or was always rare, in practice when discussing 80% of K, the focus of discussions here will need to be on what level of bycatch causes that reduction of 20% of K rather than the historical level of K.

The need to reflect on the time horizon on which to base K was highlighted. Participants recognised the power of the genetic methods to estimate effective population size going back even millions of years, which was interesting. However, participants questioned the relevance of historic population figures to setting current conservation management objectives. On the other hand, estimates of effective population size from a few generations ago may be more indicative of carrying capacity. It was noted that again, the requirements of the EU Directives should be taken into account when considering which time horizon for K should be used, as only relying on current levels of estimated K would result in an ever changing, and likely lowering, goal, which does not reflect the aims of the directives to restore populations to a favourable conservation status, for example.

Mr Hoelzel clarified that there are many ways to estimate effective population size using genetics. The Linkage Disequilibrium (LD) method provides a way to estimate **contemporary Ne** which would be most relevant to inform current management objectives. He clarified that those methods have been discussed by the IWC and published in the Journal of Cetacean Research & Management (Waples et al., 2018). The additional step of converting Ne to Nc is necessary in the management context, although it is Ne that directly affects the genetic diversity of the population.

It was suggested that the evidence used to define Management Units is often based primarily on genetics, whereas the definition adopted from the ASCOBANS population structure workshop proposed a definition that also included ecological criteria and was a more practical management approach to investigate where populations/management units are demographically distinct; the two will not necessarily be the same (as noted in Prof. Hoelzel's presentation).

Barbara Taylor noted that in the US, the concept of Demographically Independent Populations (DIPS) is used, with a number of documents available to describe that approach. This is akin to the objective of maintaining animals throughout their range.

In response to a question on the quality of genetic data (microsatellites, minimum number of loci used etc), Mr Hoelzel updated participants that the IWC are currently working on a report on DNA quality which will be published in due course.

The potential value of sequencing the whole genome was noted. It can be powerful when identifying management units. Having many SNPs across the genome can violate the assumption of the LD method that assumes no physical linkage, but this can be easily accounted for with corrections (as described in Mr Hoelzel's presentation).

2.3 Approaches used in the US for setting limits to removals

Paul Wade introduced the US Marine Mammal Protection Act (MMPA) and the approach taken in the US to set limits for bycatch removals.

The MMPA prohibits "take" of all marine mammals regardless of status (with limited exceptions). The conservation standard set out in the MMPA is that they should be at an Optimum Sustainable Population (OSP) level. The OSP does not have a scientific definition, but it does have a management definition that is somewhere in the range between Maximum Net Productivity Level (MNPL) and carrying capacity (K), where MNPL is taken to be 50% of K. Populations thought to be below Maximum Net Productivity Level (MNPL) are considered depleted. However, assessing whether or not a population is at OSP or depleted has proven very challenging, often requiring many years to collect data, and frequently there has been insufficient data available.

In response to the limitations of data availability, a new management scheme was proposed with a premise to work in a more data poor environment, that would use estimates of abundance, and of human-caused mortality, and would incorporate information about the maximum growth rate (known as R_{max}). It would also explicitly account for uncertainty.

The Potential Biological Removal (PBR) is **the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population**. It was defined to include three terms:

$$PBR = N_{MIN} * \tfrac{1}{2} R_{MAX} * F_R$$

- N_{MIN} = the minimum population estimate of the stock
- R_{MAX} = the maximum net productivity rate
- F_R = a recovery factor (F_R) between 0.1 and 1.0

The N_{MIN} term is used to explicitly take into account uncertainty, on the basis that ½ R_{max} brings the population above 50% of maximum productivity level. The Act does not give more guidance on the recovery factor other than it is between 0.1 and 1.0 and so they made some choices on how to use that.

Mr Wade explained the process for undertaking simulations, including that a range of CV values were applied, 0.2 up to 0.8, reflecting relatively precise and relatively imprecise data going in. The simulations for cetaceans used a default R_{max} of 0.04 and for pinnipeds, 0.12. They also assumed a normally distributed bycatch estimate every year, and assumed that actual bycatch was equal to the mean of PBR but with a variance specified at CV=0.3

Mr Wade presented simulations and scenarios under PBR management to assess recovery levels. This included taking a minimum population size (N_{min}) that was 30% as well as the traditional 20% of the Maximum Net Productivity Level. The team examined whether simulated populations that started at the maximum net productivity level (MNPL) stayed there or went above it after 20 years, and if 'depleted' populations starting at 30% of carrying capacity (K) recovered to at least MNPL (50% of K) after 100 years. A probability of 95% to get to 50% of K was used. The 100-

year timeline was chosen on the basis that any longer time period would be beyond the time frame that management could typically work to, although he pointed out that some populations were not reaching equilibrium even at the 100-year point.

Trials were also run in order to test assumptions that were made in the simulations, e.g. if the mortality estimate was biased too low. In addition, Mr Wade drew attention to a recent paper by Punt et al. (2020) that looks further at the robustness of the PBR. He pointed out that in Wade (1998), there are also simulations to address a recovery rate goal for endangered species, which uses a lower reference point for the PBR in order to allow populations of endangered species to grow as quickly as possible.

Mr Wade explained that in the US, the PBR acts as a **trigger** for management action if exceeded. Stocks with mortality greater than the PBR are considered to be 'strategic' stocks. In addition, fisheries are categorised so that Category 1 fisheries are those whose bycatch is exceeding PBR; Category II fisheries are those in which bycatch is exceeding 50% of PBR; and Category III fisheries those where bycatch is below 10% PBR. Under the MMPA, Take Reduction Teams are formed to come up with a plan to reduce bycatch of strategic stocks that interact with Category I or Category II fisheries, or for non-strategic stocks that interact with Category I fisheries.

The Take Reduction Plans have both short-term and longer-term goals. The short-term goal is that, within 6 months, mortality and serious injury should be less than PBR, although in practice this has proved too ambitious a time frame to achieve the necessary change. The long-term goal is that within 5 years, mortality and serious injury have moved to an insignificance threshold (defined as 10% of PBR).

Mr Wade reflected on the success of the stock assessment process and whether it has actually led to a reduction in bycatch by getting it below PBR. The picture is mixed, with some success for some populations of some species but less impact on others. Mr Wade also noted that the PBR approach has also been used outside the USA including New Zealand, Australia, UK, Mexico, Canada, and by NAMMCO. It is also being used beyond marine mammals and for some seabirds.

Mr Wade highlighted the Marine Mammal Protection Act Import Rule whereby fish imported into the US will need to meet the same standards on bycatch that domestic fishers are required to meet. Fish exports from the ASCOBANS region to US will have to meet these requirements. The Marine Mammal Bycatch Impacts Exploration Tool has been developed to support countries to meet those requirements. The magnitude of bycatch is currently limited to a maximum of 2,000 individuals annually.

Finally, Mr Wade noted that there will be instances where the reference point is wrong, e.g. if the reproductive rate is compromised by contaminants or if K is declining due to climate change, for example. The PBR has a 'safety net' in that if there was an underlying problem with management, there would be feedback that the population is declining, which may then trigger additional management action. In cases where it is known that pollution, for example, may suppress population growth, this can be considered within the PBR formula by lowering the value for the 'default' R_{max}. Other variables that can be changed within the PBR formula includes the recovery factor, Fr, which varies from 0.1 to 1, with lower values employed for stocks in poorer conservation status.

Discussion

Participants discussed the importance of a timely response in management action if the population declines. This can be especially challenging if the reason for the decline is not obvious. Mr Wade noted that, in the US, if the cause of the population decline is unknown, it may act as a prompt for funding for more research. However, even when the reason for the decline is known, where there is a complex fishery, it can take a long time for sufficient action to be taken to reduce fisheries bycatch to below PBR.

There was discussion on the short-term (6-month) and long-term (5 year) goals for the take reduction programmes. Although these timeframes are written into the MMPA, in practice it takes longer than six months to implement the Take Reduction Programmes, and time is often needed for experimentation with solutions, and some trial and error (e.g. with gear types).

There have been some success stories where bycatch has been reduced to below 10% of PBR. It was achieved, for example, for the drift gillnet fishery off the west coast of USA in which they put pingers on the nets which reduced bycatch of small cetaceans; this also completely eliminated bycatch of beaked whales which was both a surprise and a success story.

Participants discussed how often the PBR estimate should be updated (as recommended in Wade, 1998 and Punt et al., 2020) as abundance estimates change over time. Mr Wade noted that this is a challenge when you have a large number of populations/stocks to manage (330 in the US) and limitations on funding to obtain abundance estimates. In their guidelines, they assumed, in the best case, a survey interval of 4 years, but also considered that abundance estimates of more than 8 years were not good enough. Because this was written into the guidelines, it initially meant that they could not calculate PBR because some abundance estimates were too old, whereas, on the other hand, they were legally required to calculate PBR. Because of this, the guidelines were revised to enable older abundance estimates to be used, although Mr Wade cautioned that this does bring the quality of management into question if old abundance estimates have to be used.

Ms Taylor noted that the robustness trials drew from the work of the IWC, who were doing similar things at the same time. In the abundance bias trial, it was deemed very unlikely to have a bias overestimating abundance by more than a factor of 2, and a recovery factor of 0.5 was applied. She highlighted the importance of incorporating population structure as, if the population structure was wrong or uncertain, it can significantly affect the abundance estimate and so this should be considered in the robustness trials.

Mr Wade drew attention to work by Jeff Moore (Moore et al., 2021) and a paper by Brandon et al. (2017) that consider some of the challenges with abundance estimates.

2.4 Approaches used in the OSPAR region of Europe for setting limits to removals

Matthieu Authier gave an overview of regional agreements in Europe that deal with marine mammals and fisheries, including ICES (fisheries management), HELCOM (Baltic), OSPAR (Northeast Atlantic), ASCOBANS (Baltic & Northeast Atlantic), and ACCOBAMS (Mediterranean).

He noted that the EU Marine Strategy Framework Directive (2008/56/EC) requires EU Member States to have a suite of descriptors to assess the status of their marine ecosystems, and one of these descriptors is: *The mortality rate per species from incidental by-catch is below levels which threaten the species, such that its* long-term viability *is ensured.*

This means that bycatch needs to be documented and long-term viability needs to be determined. The Directive is explicit that regional co-ordination should be achieved through Regional Seas Conventions.

Mr Authier pointed to an ICES advice from 2014 following an OSPAR request on how to implement this EU Directive. ICES had indicated that the proper way to set limits for bycatch was using the Catch Limit Algorithm but that key choices needed to be made at the societal/policy level for this advice to be further developed. This highlights the need for a clearly defined conservation objective.

Mr Authier noted that the ASCOBANS conservation objective (see section 2.1) did include a lower bound (to restore and/or maintain stocks/populations to 80% or more of the carrying capacity), but did not specify a time horizon nor a confidence/risk level associated with that figure. In contrast, the US Marine Mammal Protection Act (MMPA) (see section 2.3) specifies that marine mammal populations should be at their Optimum Sustainable Population, which is that a population should recover to or be maintained at or above 50% of carrying capacity (lower bound) with a 0.95 probability (confidence level) over a 100-year time horizon.

Mr Authier summarised the work undertaken by OSPAR. He drew attention to its agreed common indicator on marine mammal bycatch (M6), initially applied only for the harbour porpoise, but then extended to two other marine mammals, and applied to up to three OSPAR ecoregions: the Greater North Sea, Celtic Sea and Bay of Biscay. Approximately every 10 years, OSPAR issues a Quality Status Review, and an intermediate assessment was issued in 2017. At the time, no assessment for harbour porpoise could be made because there was no agreed threshold or limit on how much bycatch was allowable and therefore it was not possible to compare the magnitude of bycatch against a limit to determine whether or not it was affecting its long-term viability.

In 2018, the OSPAR Marine Mammal Expert Group (OMMEG) was reactivated, and in 2019 a joint OSPAR-HELCOM workshop on bycatch was held. Also in 2019, a report on a Removals Limit Algorithm (RLA) for the harbour porpoise was published by the UK Joint Nature Conservation Committee (JNCC) (Hammond et al., 2019). In 2020, the European Commission started an infringement procedure against three EU Member States for failing to implement the strict protection of marine mammals.

Against this background, the ICES Working Group on Marine Mammal Ecology (WGMME) decided to use the US PBR formula to assess by-catch of common dolphins in the Bay of Biscay, recognising that the formula had been tuned to the conservation objective of the US MMPA. ICES (2020) in computing a PBR for common dolphins in the Bay of Biscay as part of the Workshop on Emergency Measures to mitigate BYCatch of harbour porpoise in the Baltic Sea and common dolphin in the Bay of Biscay (WKEMBYC) noted as a caveat that the PBR did not align with EU conservation objectives (ICES 2020, page 100). From 2021, OSPAR OMMEG held a series of meetings to discuss further development of the common MSFD indicator for marine mammal bycatch (M6) and thresholds for bycatch, building on previous work, and, in spring 2021, it decided to use the following conservation objective, that “a population should recover to, or be maintained at or above 80% of carrying capacity, with an 0.80 probability over 100 years.

In response to this, work was undertaken to tune the PBR to this new conservation objective and the same base case scenario carried out as Wade (1998), with similar robustness trials, but with an assumption that they would have a new abundance estimate every 6 years. All other specifications for the operating model underlying the simulations were the same as in Wade (1998), and the results of this tuning are reported in Genu et al. (2021):

- PBR = $R_{max}/2 \times N_{min} \times Fr$

Where

- R_{max} =4%
- N_{min} – 20% quantile of log-normal distribution of the best available abundance estimate
- Fr = 0.1[2]

With this, a 2023 OSPAR bycatch assessment could be undertaken, and the report is now available (OSPAR, 2023). The assessment is underpinned by a conservation objective attempting to capture the European ambition of ASCOBANS for setting bycatch limits, subject to adjustment for future assessments to accommodate new evidence.

Discussion

It was noted that this modified PBR approach developed within OSPAR was also reviewed and implemented by HELCOM EG MAMA, for assessment of the Belt Sea population of harbour porpoises. Discussion on the points raised are summarised in section 3 for ease of reading.

[2] It was mentioned that with no bias, Fr can be increased to 0.35. The value 0.1 is when by-catch is underestimated, or when abundance is overestimated.

2.5 A Stochastic Model to Set Sustainable Limits to Wildlife Mortality in a Changing World

Oliver Manlik introduced work on a Stochastic Model to Set Sustainable Limits to Wildlife Mortality in a Changing World (Manlik et al. 2022). Mr Manlik noted that it offers a modelling approach that incorporates stochastic factors to estimate limits to human caused mortality of wildlife such as fisheries bycatch. The SAMSE (Sustainable Anthropogenic Mortality in Stochastic Environments) limit is the number of individuals that can be removed without causing a stochastic population decline.

SAMSE incorporates demographic stochasticity, environmental stochasticity, catastrophes, and dependency upon offspring impacts. Mr Manlik explained that if looking at a purely deterministic model, this does not incorporate stochastic events, and the model might demonstrate a steady growth of the population which might not be the case. When you incorporate stochasticity into your model, then even with a positive growth rate, you may still have a decline due to stochastic events. This shows the importance of taking into account stochasticity in modelling.

The steps taken in the SAMSE approach include:

- Use of a Vortex population model
- Set up of a standard model of a stable population without bycatch. A good reference population is needed for this that is demographically and taxonomically similar to the study population.
- Incorporation of stochasticity – a demographic model, incorporating dependency of offspring (as the offspring of cetaceans are usually dependant on the mothers), plus environmental stochasticity
- Trial scenarios until forecasts that produce non-negative stochastic growth rates are reached – the SAMSE limit

Mr Manlik explained that they also ran the PBR approach on the test population (based on a stable bottlenose dolphin population in Shark Bay, Australia) and found that the SAMSE removals limit was much lower than the PBR calculated for the same population. He noted that whereas the original PBR does not incorporate stochastic factors, some of the modified versions do (e.g. Punt et al., 2021).

The advantages of the SAMSE approach is that it can incorporate demographic and environmental stochasticity; it can incorporate surrogate data from well-studied, stable reference populations; it is broadly applicable to a large range of taxa and situations (not just bycatch); it can incorporate other threats (akin to changing R_{max}); and can be performed using off-the-shelf modelling software. A key limitation is the need to find a good reference population to get reliable surrogate data, a population that is taxonomically and demographically similar, needs to be well studied, and have an absence of bycatch and other human induced mortality.

Going forward, the goal is to incorporate a module into Vortex to report SAMSE-limits and potentially to create a “library” of pre-configured reference populations.

Discussion

Participants welcomed continued exploration for what can be done with PBR-like tools. The importance of demographic stochasticity was highlighted especially for small populations. One participant questioned whether the advantages of SAMSE could also be applied to PBR, and Mr Manlik clarified that recent work such as Punt et al. (2020) did incorporate stochasticity, but the SAMSE approach is more powerful in this regard. Other participants noted that different operating models and an age-structured model could be incorporated into the PBR (as Brandon et al., 2017, Authier et al. 2020, and Owen et al. 2022 have done), and so they considered that PBR did have the ability to adequately consider demographic stochasticity.

Jeff Moore reminded the group that PBR is a tool that is applied in a data poor context, and it runs on the basis of a number of assumptions, e.g. that the only information on abundance will be generated every 4-6 years. However, as other data become available, including on environmental stochasticity, one would be able to better evaluate whether your management approach is on track, and it will not always be necessary to work in a PBR framework. For example, the PBR approach is not used to manage North Atlantic right whales because there is a lot more information on that population that can enable a more detailed evaluation. He suggested that ASCOBANS may wish to consider the feedback between data and management which gives more flexibility and leeway in some of the take estimates.

Mr Manlik explained that the SAMSE approach is also applied in a data poor situation where there is limited information on the population. Instead, a reference population is used as a surrogate for the study population. Mr Authier noted that in Europe there are a lot of data poor populations, and a reference population may not be available for many of them. Although SAMSE was an elegant approach, it remains data hungry.

Mr Manlik clarified that the SAMSE approach is not intended to be a replacement for PBR. He concurred that finding a suitable reference population to get reliable surrogate data was the main challenge, but suggested that if there is a reference population, both PBR and SAMSE approaches could be used.

3 Discussion

3.1 Conservation Objectives

Participants noted that the main aims of the workshop were to reach an agreed usable quantitative management objective (e.g. maintaining the population at a certain percentage of carrying capacity for a certain percentage of cases over a temporal window of x years), and a recommended approach to setting thresholds[3] appropriate to different small cetacean species, that is both precautionary and practical to apply.

No participants asked for the current ASCOBANS conservation objective to be changed from 80% of K but additional detail needed to be developed, particularly with respect to a time horizon and a level of probability, and there should be a clear rationale for any changes/additions made.

One proposal was that the conservation objective be retained at 80% of K with a defined probability over a time span of 100 years. Since OSPAR OMMEG had developed a quantitative sub-objective that effectively combined elements of the ASCOBANS conservation objective and the US MMPA conservation objective, one possibility was to adopt the OSPAR ‘modified PBR’ approach as the conservation objective.

There were differing views on whether it would be useful to adopt a conservation objective that specified a time horizon or to leave the time horizon to be developed at a later stage in the process, when running the operating models. Several participants felt that the inclusion of a time horizon removed flexibility. It was suggested that this detail could be specified in a guidance document or a sub-objective. In the US MMPA, much of the operational information is in the guidelines, which allows some flexibility in interpretation of the law. The time horizon was developed for the modelling process, and on the policy side in the US, a 95% probability was set.

Several other participants emphasised the importance of a clear and sufficiently detailed conservation objective, as there has already been a lot of back and forth within OSPAR and HELCOM, which has led to greatly increased workloads, and prevented thresholds from being set

[3] The terms recommended by the 2015 ASCOBANS Workshop on Unacceptable Interactions were ‘environmental limits’ and ‘triggers’, see workshop report.

and assessments carried out, which delays management action in areas where it may be needed, and limits the ability of countries to fulfil the MSFD.

Participants noted that there are different arguments for different time periods and probabilities, and a decision on these elements was important in order to move forward. A newly defined conservation objective driven by ASCOBANS would likely be applied within other European conventions (e.g. OSPAR and HELCOM), as has already happened, albeit with a particular interpretation (of 80% probability and 100-year time span) on the current objective. It was also noted that there is a requirement from the EU to have SMART objectives, which by definition need to be time bound. If it was not possible to specify a year, an alternative approach might be to make a recommendation on how to be time bound so the process is specified. The objective of reducing bycatch rates below a specified threshold can be a SMART objective even when the objective of reaching a specified population target is not.

There was some discussion on whether other anthropogenic impacts should be reflected in the conservation objective, even if the focus of this workshop is bycatch (see also section 3.2). In OSPAR's 2023 QSR, bycatch is one of five indicators used to assess biodiversity and it would be helpful if ASCOBANS mirrored or reflected what OSPAR Contracting Parties are already having to report upon.

Participants discussed the possibility of having a spatial component in the conservation objective to ensure that the management triggered is appropriate, e.g. calculating an appropriate limit for a particular fishery in a particular area. However, this should be at least at the level of the population so far as this can be determined. When ASCOBANS first adopted its conservation objective, Management Units (MUs) were not under consideration. However, Management Units are now used in the management of bycatch where populations are believed to be demographically distinct, and so it could be valuable to be explicit on the spatial aspect in the conservation objective with reference to what are believed to be biological populations. In terms of targeting fisheries spatially, it was noted that in the EU there are multiple fisheries with different gear types impacting the same population which adds a layer of complexity to defining where the fishery is, and what flag it flies. Additionally, the EU directives call for the management unit to be assessed, not the individual fisheries.

Participants agreed that the justification for any conservation objectives that are proposed needs to be clearly elaborated and communicated. Ms Taylor noted that, in the US, to help take decisions on the conservation objectives for the MMPA, scientists have presented options showing different scenarios for the populations over a 100-year period depending on the parameters chosen. This was an extensive process, which included testimony to Congress and opportunity for public comment.

After extensive discussion (see also sections 3.2-3.5), some participants agreed that more than one option for conservation objectives could be developed and discussed by email to present to the Part 2 Workshop. These could then reflect more than one probability and perhaps both a 20- year and 100-year time frame. They should take into account the conclusions from the discussions over carrying capacity which broadly accepted continuing to use 80% of K, and probability values (maybe with a couple of options, e.g., 80%, 95%). The pros and cons of the options could be reflected, along with commentary on how they compare to the ambition of the last 20 years, and to the PBR approach in the US. However, it was raised that this work, which would be time-consuming and highly technical, may not be possible to achieve prior to Part 2 given the time constraints between the two meetings and no allocated funding for the work required. Yet, fundamental concepts of how the objective could be operationalised could be effectively explore in the interim to start the process.

3.2 Carrying Capacity

Conservation objectives for marine mammals have often been to restore and/or maintain populations to a certain percentage or more of their carrying capacity (K), i.e. the maximum number of individuals that an area or habitat can support dependent upon available resources This is a challenging task which has been translated in objective to ensure with high confidence that the populations are not depleted (for example the move from trying to estimate OSP to estimating PBR in the USA). In some cases, however, carrying capacity has been taken to be the abundance estimate available that is closest to 1992 when the EU Habitats Directive came into force, although this refers to Favourable Reference Values (FRV) and not specifically carrying capacity. Many marine mammal populations were likely already depleted by 1992, and therefore the FRV may be below what could be understood as carrying capacity. One challenge therefore is to determine whether the ecosystem has changed sufficiently to have modified the current carrying capacity below historic levels. If that's the case, a second challenge is to determine whether the ecosystem could plausibly return (or be returned) to this previous more desirable state or to alternative states that would yield similar carrying capacity levels for marine mammals.

Some participants raised concerns about how carrying capacity (K) could be estimated. For example, data might not be available for some populations if a specified date was chosen (e.g. 1992 when the Habitats Directive came into force). Concerns were also raised about adjusting K according to updated population abundance estimates which would effectively mean lowering the goal posts to the worst state every six years, which would mean the population is unlikely to even "maintain" its current status, let alone ever "recover". Rather, it was noted that recent abundance estimates should perhaps not be related to carrying capacity, and, instead, a baseline value would be more useful. It was also noted that in a degraded ecosystem, carrying capacity might be too low to sustain the target population size - even with good management of bycatch, it may not be possible to achieve the conservation objective if other factors are at play preventing the population from growing. Mr Authier noted that the EU, through its Marine Strategy Framework Directive, is keen to restore populations that were previously depleted, and the Directive is explicit that restoration of populations is not to a pristine state but that human activities will need to be taken into consideration.

There was much discussion on the interplay of the impacts of bycatch with other pressures such as habitat modification, pollution, anthropogenic noise and other disturbances, reduced food availability etc, and the importance of taking these other human influences into account. Participants discussed whether an objective of 80% of K incorporated the impacts of other anthropogenic activities noting their importance.

There was extensive discussion also on whether there was a need to choose a value for K; instead, the objective could be to maintain the population at/above 80% of K, whatever K might be. Some participants noted that K will change over time, with some populations already reduced and others roughly where they should be. Instead of identifying a number for K, it would be more appropriate to determine what level of bycatch is going to achieve the conservation objective – and it is possible to do this without defining K. Drawing on experience of the MMPA in the US, Mr Wade explained that initial work trying to estimate K was very 'data hungry', and the move towards the PBR approach removed the need to estimate K. Instead, the process allows calculation of bycatch rates that either maintain the population or allow population growth. Ms Taylor suggested that if the ASCOBANS conservation objective is to 'maintain healthy populations throughout their range', instead of defining K, a more practical approach might be to look instead at their spatial distribution and growth rates and if these were declining, then the objective is not being met.

It was noted that, in practice, when referring to an impact that directly kills or removes animals, it tends to be framed as a reduction of population size compared to K, whereas when referring to habitat degradation or pollution impacts, they are considered to cause a reduction in K. However, direct removals can be estimated and so are, in one sense, straightforward whereas when considering the impacts of habitat degradation or pollution on lowering K, it becomes almost impossible to come to a single number.

Other participants argued that it was important to know the status of the management unit being conserved, and it would be useful to identify a reference point. In the EU, the Marine Strategy Framework Directive refers to baseline levels rather than K, which might be easier to define. One suggestion was that a specific target could be useful for depleted stocks, where the target might be higher than the population is currently. But for species that are more common, it is not feasible to say what a target might be, and whether the species is above or below it. Therefore, a general definition for K is not practical, and when applying PBR, for example, it is not necessary.

Given the challenges around estimating K, some participants questioned if this was the most appropriate conservation objective or whether it should be replaced. Others felt it remained a relevant objective, as even if an estimate for K was unavailable, action could still be taken. Using the PBR approach, however, as stated earlier, precise knowledge of K is not needed for the simulation work. All that is needed to set a removals limit is some idea of the magnitude of K; demographic stochasticity will play a greater role in smaller populations (those with a small K or those which have been heavily depleted).

Participants noted that choosing 80% of K was a policy decision. They discussed the reasons for choosing 80% of carrying capacity (K) (rather than another %), noting that it was a limit at which it was reasonable to assume the population reduction was not having a substantial impact. It was suggested that a reduction of 20% (i.e. to 80% of K) may be within the typical range of variability that a population might naturally face due to environmental stochasticity, but the Workshop had insufficient information to evaluate this for the populations of interest. In addition, as discussed previously, given the multiple anthropogenic impacts that cetaceans face, it would not be appropriate to offset the entire resilience of the population with just one impact (bycatch). Participants noted that the explicit goal of PBR is to ensure with high confidence that the population does not drop, or recovers beyond 50% of K. Participants noted that the US PBR has already been through substantial political and public scrutiny so that there was value in following their lead.

In conclusion, participants generally agreed that the conservation objective should remain ‘to restore and/or maintain biological or management units to/at 80% or more of the carrying capacity’, but in the context that no single impact should reduce the population by more than 20%. The focus of the conservation objective of 80% of K will inevitably be upon bycatch as, currently, it is the single most obvious source of direct anthropogenic mortality for cetaceans.

3.3 Time Horizon

Participants noted that the current ASCOBANS conservation objective does not specify a time period in which it should be applied.

Some participants felt that a time horizon of 100 years was too long to be meaningful from a policy perspective given the difficulty of specifying scientifically defensible scenarios so far into the future. Participants also reflected that the starting point of the population (depleted, referred to in the US as <50%, or already at 50% or 80% of K) is important with respect to the time horizon applied. For example, when undertaking a management strategy evaluation on a population that is already depleted to 30% of K, for example, then a different time horizon would be needed as compared to a population that was starting at 60% of K. In each case, the population might be increasing but the time horizon needs to be long enough to reach the goal. Drawing on experience in the US, Mr Wade noted that it is also important that the time horizons and starting level of depletion are in a combination that allows an equilibrium level to be achieved.

Noting the work already done in the US and by OSPAR OMMEG, most participants thought that a time horizon should be included in the conservation objective, and that options for a 20-year and 100-year time horizon could be presented to consider those populations that may or may not be depleted, in combination with the options for probability (see section 3.4). It was noted that the time horizon for achieving bycatch thresholds should generally be shorter than 100 years.

3.4 Probabilities

ASCOBANS set the conservation objective “to restore and/or maintain biological or management units to/at 80% or more of carrying capacity”, but did not specify the probability (i.e. % of cases) for achieving this. OSPAR OMMEG and HELCOM EG MAMA used a probability of 80% of cases when setting thresholds for the most recent round of assessments (QSR 2023 and HOLAS III respectively).

Participants noted that the simulations of recovery undertaken in OSPAR were run at 80% probability. In those simulations, it was felt that a 95% probability for an objective to reach 80% of K would generate thresholds that are too stringent. Conversely, a 50% probability would not give sufficient reassurance on what was happening to the population.

The possibility of considering different risk tolerances was also noted which could depend on the conservation status of the stock. For example, a less cautious management approach could be taken for a large and healthy population and a more cautious approach taken for a population with conservation concerns.
Some participants were not in favour of including the probability in the conservation objective with concerns that, from a scientific perspective, in order to define a probability, other details also need to be specified to be scientifically valid.

After much discussion, the remaining participants[4] recommended that scenarios for 2-3 probabilities be developed by email ahead of the second workshop and presented there for a decision.

3.5 Using R_{max}

Participants discussed whether changes to R_{max} (the maximum theoretical or estimated net productivity rate at small population size) and/or to the recovery factor (Fr) could help address some of the issues raised during the discussions on carrying capacity and how to address some of the other anthropogenic impacts. It was noted that changes to R_{max} require a biological argument whereas the recovery factor (Fr) is a policy decision. For example, some threats might be temporary e.g. building a wind farm might have short term impacts, and then have a lower impact during this time. Ms Murphy noted that changing R_{max} has also been discussed within OSPAR for the harbour porpoise, which included discussions on whether an R_{max} estimated for a population outside European waters should be used.

In the US, a default R_{max} (0.04 for cetaceans) is used, and the guidelines do allow moving off that but on a stock specific basis and with appropriate evidence. It was not recommended to employ an R_{max} estimate from another population, for example, and impacts of other stressors, such as pollutants, also could be considered. Ms Taylor emphasised the importance of the concept of a default value, noting that as it will be used for most species, it is important to choose a value that all species can achieve otherwise the conservation objective will not be achieved.

Participants discussed R_{max} as representing a normal reproductive rate that occurs in ideal conditions (with no bycatch, no underwater noise, no ship strikes etc), noting that it would sometimes decrease in bad years (with reduced prey availability) and never go significantly above it due to the reproductive constraints of the species. However, challenges in defining and using R_{max} were noted given the variation across many populations and for marginal populations. The need to introduce a density dependent effect was suggested, to determine maximum net productivity for individuals in, for example, a low-density environment.

Participants discussed whether it would be useful to have a conservation objective whereby the observed rate of growth of the population is close to the R_{max} rate of growth. This could be used as a way of implementing the conservation objective of 80% of K. However, participants questioned whether using R_{max} instead of K solves the problem, given that R_{max} data are not available for many species, and, additionally a baseline would still be needed (would it be R_{max} today, or ten years ago, or 1992, etc).

[4] The discussion ran over time and not all participants were able to stay on.

3.6 Fixed % of best abundance

In practice the ASCOBANS threshold of 1.7% of the population size of the harbour porpoise (with a precautionary threshold of 1%) has been applied for the most part to bycatch estimates and not to other anthropogenic pressures, many of which may not cause direct mortality but instead either reduce reproductive output or limit carrying capacity (e.g. prey resource depletion).

Participants were asked to consider whether it is appropriate to use a percentage of the population size, and if so, does 1.7% still apply to the harbour porpoise, and not necessarily thresholds for other species with different life history parameters. Ms Murphy expressed concern that other fora have been employing the generic bycatch figures of 1% and 1.7% without due account of the caveats around those numbers.

It was noted that a management threshold of 1.7% specified in ASCOBANS Resolution 3.3 was based on a purely deterministic calculation of the bycatch level that corresponds to an equilibrium population at 80% of K, with no associated probability level. It is based on R_{max} = 0.04 (the default value used for PBR calculations), coupled with an assumed MNPL that is 60% of K. The 1.7% threshold is very sensitive to the assumption that MNPL is 60% of K. For example, if MNPL dropped to 50% of K (a value which becomes more plausible when there is density dependence in multiple demographic parameters and especially in the presence of environmental variability), then the corresponding threshold would be 0.8%. Therefore, the bycatch limit is very sensitive to the assumed MNPL.

Due to a lack of time, participants were unable to have a full discussion of this issue, and it was agreed to revisit this preferably in Part 2 but otherwise at a later date.

3.7 Terminology

Participants discussed the terminology used when describing the reference point for bycatch limits. Mr Wade noted that the PBR represented one particular reference point tuned to the objectives of the US MMPA. The reference point used by ASCOBANS would not be the same PBR as it will be tuned to a different objective reflecting the ASCOBANS priorities. Mr Authier concurred, noting that in OSPAR, the name ‘modified PBR’ was used. The lower bound was altered to reflect the conservation objective of 80% of K with a probability of 0.8. Mr Authier reflected that it was actually the conservation objective that was modified and not the entire PBR framework. Mr Wade added that the PBR is heavily associated with the MMPA in the US and as Europe is taking a different approach, he would be tempted to suggest changing the name, although PBR-like reference point or modified PBR could also work.

Mr Wade noted that in the US, words like ‘limits’ and ‘thresholds’ are avoided as they imply that a fishery may be closed. Instead, reference point was deemed to be more of a neutral term. Mr Moore added that there are different types of reference points, and, academically speaking and drawing from fisheries literature, PBR is a limit reference point, i.e. if you go beyond it, action is taken.

Participants noted that in the EU Marine Strategy Framework Directive, there are already specific references to indicator thresholds for determining good environmental status (GES) of marine waters. The word ‘threshold’ is used for all marine mammal abundance and distribution indicators, not just for bycatch and thus it would be good to have consistency across fora. When thresholds are exceeded, indicators are deemed to be in a poor environmental status, which in practice, is a trigger for governments to work together to change it via programmes of measures, under, for example, the MSFD. Previously, as outlined during Ms Murphy’s presentation, the 2015 ASCOBANS workshop on ‘Unacceptable Interactions Part 1’, proposed the term ‘environmental limit’ as a “critical” or “unacceptable” point in the environment that should not be exceeded. It was suggested that words like ‘environmental trigger’ could also be introduced as something which prompts action, action that would be required to ensure that environmental limits to avoid decline are not exceeded.

3.8 Exports to the US

Participants recalled the Marine Mammal Protection Act Import Rule whereby fish imported into the US will need to meet the same standards on bycatch that domestic fishers are required to meet. Participants agreed that the reference point used in Europe needs to be at least as stringent as that which is required by the MMPA, to ensure fish exports can continue. It was noted that in the Federal Register there is reference to any country that is a Party to ASCOBANS and meeting their objectives, was considered to be applying standards similar to the Marine Mammal Protection Act.

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Annex 1: Agenda

**AGENDA for ASCOBANS EXPERT WORKSHOP to
SET CONSERVATION OBJECTIVES & REVIEW THRESHOLDS
FOR UNACCEPTABLE INTERACTIONS**

16:00-19:00 CEST, Mon 24th and Tues 25th April 2023 (online)

Introduction

Presentation: ASCOBANS Conservation Objectives – Sinéad Murphy

Presentation: Introduction to genetic methods on estimating population size and identifying management units – Rus Hoelzel

Topic: A) Setting a short-term practical conservation sub-objective to restore and/or maintain populations at 80% or more of carrying capacity.

Discussion Points:
Carrying Capacity
Percentages and Probabilities used in Setting Conservation Objectives
Time Periods

Topic: B) Approaches to Setting Bycatch Limits (incorporating other anthropogenic removals)

Presentation: Approaches used in the US for setting limits to removals – Paul Wade
Presentation: Approaches used in the OSPAR region of Europe for setting limits to removals – Matthieu Authier
Presentation: Alternative methods used whilst also incorporating stochasticity – Oliver Manlik

Discussion Points:
Potential Biological Removals (PBR)
Modified PBR
Removals Limit Algorithm (RLA)
Anthropogenic Pressures
Variation in Life History Parameters
Management/Assessment Units
Incorporating Stochasticity
Threshold Setting Approaches
Management Action Response Times

Annex 2: List of Participants

Name		Affiliation	Country
Matthieu	AUTHIER	La Rochelle Université / Observatoire Pelagis	France
Justin	COOKE	Independent consultant	Germany
Line	CORDES	Norwegian Institute for Nature Research	Norway
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