Marine Mammal Commission
An independent agency of the U.S. Government

Review of the National Marine Fisheries Service's Marine Mammal Stock Assessment Reports

Range, Abundance, and Potential Biological Removal

June 2016

TABLE OF CONTENTS

Suggested citation for this report:
Simmons, S.E. 2016. "Review of the National Marine Fisheries Service's Marine Mammal Stock Assessment Reports: Range, Abundance and Potential Biological Removal." Marine Mammal Commission, Bethesda, MD 20814. 16 pages

PURPOSE

This report reviews the efforts by the National Marine Fisheries Service (NMFS) to assess marine mammal stocks as required by Section 117 of the Marine Mammal Protection Act of 1972 (MMPA, the Act, 16 U.S.C. et seq.).[1] Congress passed the MMPA in 1972 to conserve marine mammals and ecosystems. In the Act (16 U.S.C. 1361), Congress found that—

Humpback whale with calf in NOAA's Hawaiian Islands Humpback Whale National Marine Sanctuary. (NOAA)

> (1) certain species and population stocks of marine mammals are, or may be, in danger of extinction or depletion as a result of man' s activities; [and]
>
> (2) marine mammal species and population stocks should not be permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part, and, consistent with this major objective, they should not be permitted to diminish below their optimum sustainable population[2]...;

Importantly, Congress also found that—

> (3) there is inadequate knowledge of the ecology and population dynamics of such marine mammals and of the factors which bear upon their ability to reproduce themselves successfully….

To address these findings, Congress directed that a science-based approach be developed to manage marine mammals and the human-related risks that threaten their persistence. To assess marine mammal stocks, Section 117 of the Act (16 U.S.C. 1386, as amended in 1994) specifies that each stock in U.S. waters be assessed with regard to the following information—

> (1) geographic range;
>
> (2) minimum population estimate, current and maximum net productivity rates, and current population trend;
>
> (3) human-caused mortality and serious injury rate;
>
> (4) interactions with commercial fisheries;
>
> (5) current status; and
>
> (6) potential biological removal level (PBR).

[1] The Service is responsible for assessing the status of all marine mammal stocks that occur in U.S. waters except the manatee, polar bear, sea otter, and walrus, which are studied and managed by the Fish and Wildlife Service (16 U.S.C. 1375a).

[2] With respect to any particular stock, the MMPA defines the "optimum sustainable population" to mean "the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element" (16 U.S.C. 1362(9)).

APPROACH

The Commission reviewed stock assessment reports available as of 2014[3] (the most recent reports available at the time of this review) to evaluate performance of NMFS in gathering, assessing, and reporting on some of the information required by section 117. The review starts by underscoring the importance of stock identification, a necessary precursor of stock assessment. The review then highlights NMFS's progress in obtaining information on three of the six requirements of Section 117 (requirements 1, 2, and 6). Those three requirements provide the foundational information necessary to manage any stock: where and when it occurs (requirement 1), the number of animals in the stock (requirement 2), and whether there is enough information to derive a management metric. In the case of marine mammals the management metric is potential biological removal (PBR) (6th requirement). Without this basic information the status of a stock cannot be confidently ascribed (requirement 5 of Section 117). Nor can the stocks be managed effectively even if commercial fisheries interactions (requirement 4) and other human caused mortality and serious injury (requirement 3) are well known and reported in the stock assessments. The review includes several recommendations intended to support NMFS in its efforts to improve stock assessments.

STOCK STRUCTURE

Congress identified the stock (or population stock) as the primary management unit for marine mammals (16 U.S.C. 1362.11). It defined a stock to mean "a group of marine mammals of the same species or smaller taxa in a common spatial arrangement, that interbreed when mature."

North Atlantic right whale off the coast of Florida. Photo taken under NOAA research permit #775-1875. (Florida Fish and Wildlife Conservation Commission)

An accurate understanding of stock structure is therefore the cornerstone for stock assessment, management, and conservation even though not explicitly listed among the Act's six specified information needs. Historically, marine mammal scientists identified stocks using morphologic, demographic, behavioral, and geographic range/distribution patterns (e.g., Dizon et al. 1992). However, detecting such patterns depends largely on field observations, which often are not sufficient to reveal the reproductive barriers indicative of stock structure. Stocks can be difficult to identify for a variety of reasons, such as remote distributions, cryptic behavior, and physical similarity to, and geographic overlap with, other stocks. More recently, scientists have relied heavily on genetic methods to identify and distinguish marine mammal stocks, as those methods provide important insights not always discernible through direct observations. NMFS scientists have excelled in the use of genetic tools, but inadequate resources often have undermined their efforts in this regard. Efforts to

[3] The 2013 reports are available at http://www.nmfs. noaa.gov/pr/sars/region.htm.

identify marine mammal stocks would therefore be enhanced by funding for genetic studies (including both sampling and analyses). Beyond genetics NMFS scientists recently reviewed each of the various lines of evidence to judge their respective strengths in distinguishing stocks, and provided initial guidelines for the use of such evidence (Martien et al. 2015). The Commission acknowledges and applauds those efforts and supports NMFS's continued pursuit of improving stock structure determinations, using multiple lines of evidence.

GEOGRAPHIC RANGE

Adult male northern elephant seal. Picture taken under NMFS permit #87-1743. (Sam Simmons, Marine Mammal Commission)

The first requirement of a stock assessment according to section 117 of the MMPA is to describe "the geographic range of the affected stock, including any seasonal or temporal variation in such range."

IMPORTANCE

Understanding a marine mammal stock's geographic range is essential to conservation and management effort because that range provides information relevant to the—

- stock's potential habitat requirements; that is, the physical, chemical, biological, and ecological conditions necessary for the stock's persistence;
- human activities that may affect the stock; and
- areas where stock assessment, research, and conservation may be most useful.

CHALLENGES TO DESCRIBING THE RANGE OF STOCKS

The distribution and range of most marine mammals varies in accordance with multiple factors, such as—

- season: annual migrations are examples of seasonal variation in habitat use. Winter ranges, in particular, often are poorly described or largely unknown (e.g., eastern population of North Pacific right whales, southern resident killer whales, North Atlantic right whales);
- year: marine mammal stocks may vary their distributions and use of habitat annually depending on oceanographic conditions, or the timing and extent of sea ice formation and breakup (e.g., bowhead whales, gray whales);
- age: mature individuals of some species may have larger ranges or occupy different latitudes than immature animals (e.g., northern fur seals, Steller sea lions), but juveniles often disperse widely and vary their habitat-use patterns;

- sex: females and males may have overlapping ranges during the breeding season, but have more-or-less distinct ranges during the remainder of the year (e.g., sperm whales);
- reproductive status: certain portions of a stock (e.g., individuals that are either sexually immature or senescent) may use habitat different from that used by reproductively active individuals (e.g., North Atlantic right whales);
- prey availability and predator avoidance: during and outside the reproductive season, variability in prey availability and predator distribution are likely major determinants of marine mammal habitat-use patterns; and
- human-caused disturbance: may cause marine mammals to abandon or alter optimal use of key habitat depending on sources of anthropogenic disturbance.

For all these reasons, describing a stock's range and associated use of habitat is not a simple, singular challenge, but rather one that requires frequent and ongoing assessment under variable conditions. The need for frequent and ongoing assessment of range is even greater in light of potential alterations to ranges driven by climate change, which may render long-standing stock boundaries of many stocks obsolete. Determining a stock's range can be especially challenging when two or more stocks of similar-appearing individuals have overlapping ranges. For example, the ranges of the genetically distinct coastal and offshore bottlenose dolphins along the U.S. Atlantic coast overlap and because the stock affiliations of individuals cannot be visually distinguished in the field it is difficult to determine their seaward or coastal stock boundaries, respectively.

Additionally, international cooperation is needed to determine stock ranges and habitat-use patterns for stocks that occur in both national and international waters.

POPULATION PARAMETERS

Beluga whale pod in the Chukchi sea. Photo taken under Marine Mammal Permit: 782-1719. (Laura Morse, NOAA)

Section 117's second requirement is to provide "… [a] minimum population estimate, the current and maximum net productivity rate, and current population trend, including … the information upon which these are based" for each stock.

MINIMUM POPULATION ESTIMATE

Abundance information is critical for determining a stock's status, trend, and vulnerability to human activities. Stocks with low abundance generally are more easily depleted and subject to a higher risk of extinction. Examples include the AT1 killer whale stock (7 individuals), eastern North Pacific right whale stock (~30), Gulf of Mexico Bryde's whale stock (~33), southern resident killer whale stock (~80), Hawaiian insular false killer whale stock (~130), Cook Inlet beluga whale stock (~350), and North Atlantic right whale stock (~450). However, low abundance is not the only factor that could raise concern. A strong

negative trend in population size can also raise concerns. Stocks that once numbered in the hundreds of thousands (e.g., western Steller sea lion stock) or even millions (e.g., Arctic ringed seal stock) have declined or are expected to decline rapidly in the foreseeable future, increasing their risk of extinction.

Scientists are rarely able to determine the exact abundance of a marine mammal stock and must characterize the reliability of their estimates using associated measures of confidence. Reliability is measured by precision (random measurement or estimation error) and bias (a systematic tendency to over- or underestimate).

False killer whales, October 15, 2010. (Robin Baird, Cascadia Research)

The MMPA recognizes uncertainty in abundance estimates and addresses it in a precautionary manner by requiring use of a "minimum population estimate" to calculate a stock's PBR level. The MMPA defines minimum population estimate (N_{min}, 16 U.S.C. 1362.27) as an estimate of the number of animals in a stock that "(A) is based on the best available scientific information on abundance, incorporating the precision and variability associated with such information; and, (B) provides reasonable assurance that the stock size is equal to or greater than the estimate."

To review NMFS's assessment of stock abundances, the Commission tallied the stocks for which NMFS provided a minimum population estimate (N_{min}) and a best available estimate (N_{best}) with a coefficient of variation (CV; a measure of precision) less than or equal to 0.3 in the 2013 reports. A CV of 0.3 indicates about 95% confidence that the true abundance lies between 40 and 160 percent of the best estimate for an unbiased and normally distributed estimate. For example, if scientists estimated a stock's abundance as 10,000, a CV of 0.3 would indicate they could be 95% confident that the true abundance is between 4,000 and 16,000. A CV of 0.3 is considered a reasonable degree of precision for management purposes by NMFS.

Thoroughness. The 2013 stock assessments indicate that NMFS had N_{min} estimates for 138 of the 248 (56%) stocks assessed. NMFS provided an N_{min} estimate for 30 of the stocks along the Atlantic Coast (58%), 20 stocks in the Gulf of Mexico (35%), 44 stocks each along the Pacific Coast (i.e., Washington, Oregon, and California) and in the Pacific Islands (73%), 24 stocks in Alaska (53%), and none in the Caribbean (0%) (Figure 1). The 73% figure for the Pacific Islands (including Hawaii and the Pacific Territories) is misleading because it is estimated that over 100 stocks exist in the central and western Pacific but have yet to be assessed and a stock assessment drafted.

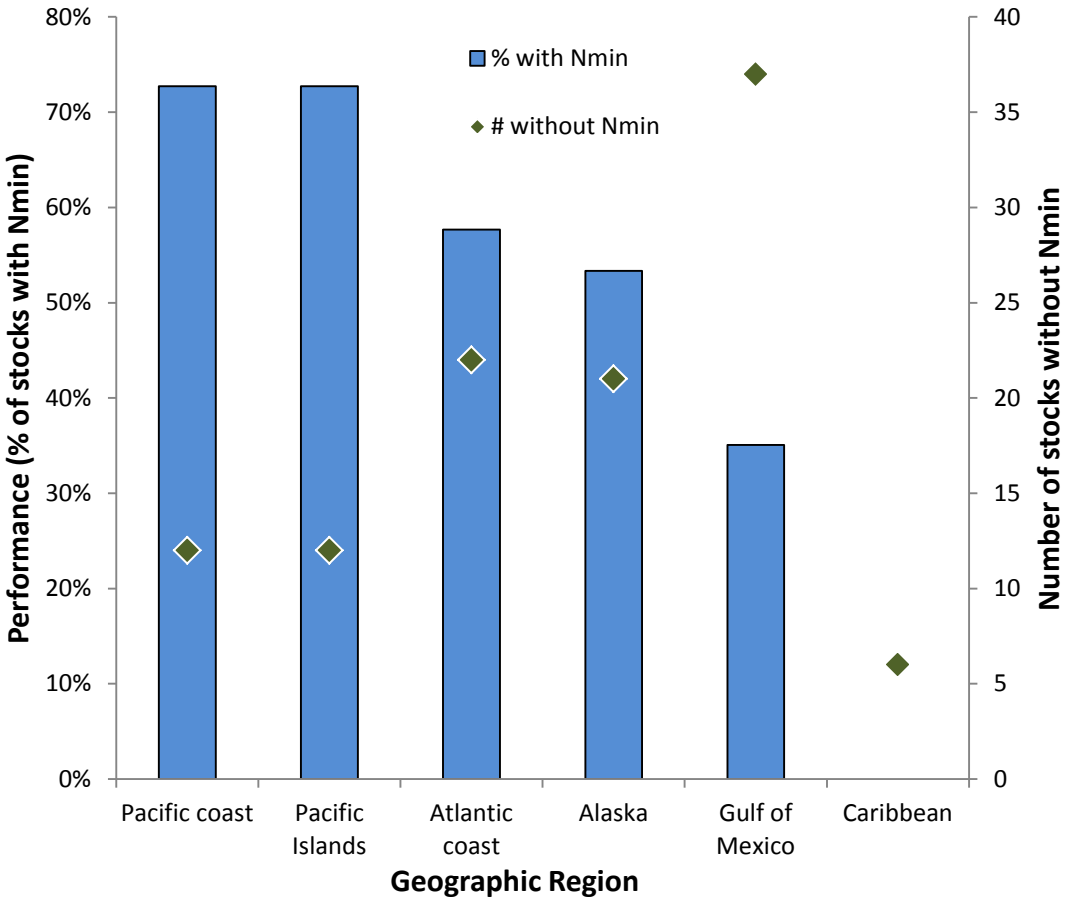


Figure 1: Performance of NMFS in the 2013 assessment reports by geographic region, with regard to % of stocks for which an Nmin was provided. The number of stocks without an Nmin is also presented (right axis) to illustrate what is required to reach 100% in each region. For example along the Pacific coast an Nmin for an additional 12 stocks would result in a 100% performance.

Precision. The 2013 stock assessments indicate that NMFS had N_{best} estimates with an associated CV less than or equal to 0.3 for 50 of the 248 stocks reported (20%). This includes 9 stocks along the Atlantic Coast (17%), 6 in the Gulf of Mexico (11%), 9 along the Pacific coast (20%), 10 in the Pacific Islands (23%), 16 in Alaska (36%), and none in the Caribbean (0%) (Figure 2).

Bias. The 2013 stock assessments reveal several sources of systematic error in N_{best} estimates.

- No estimates: NMFS scientists were not able to estimate abundances for a substantial number of stocks. Some stocks have long been neglected (e.g., Caribbean), others have only recently been recognized (e.g., spinner dolphin stocks in the Northwestern Hawaiian Islands), and still others have yet to be identified (e.g., in the central and western Pacific Ocean and Caribbean).

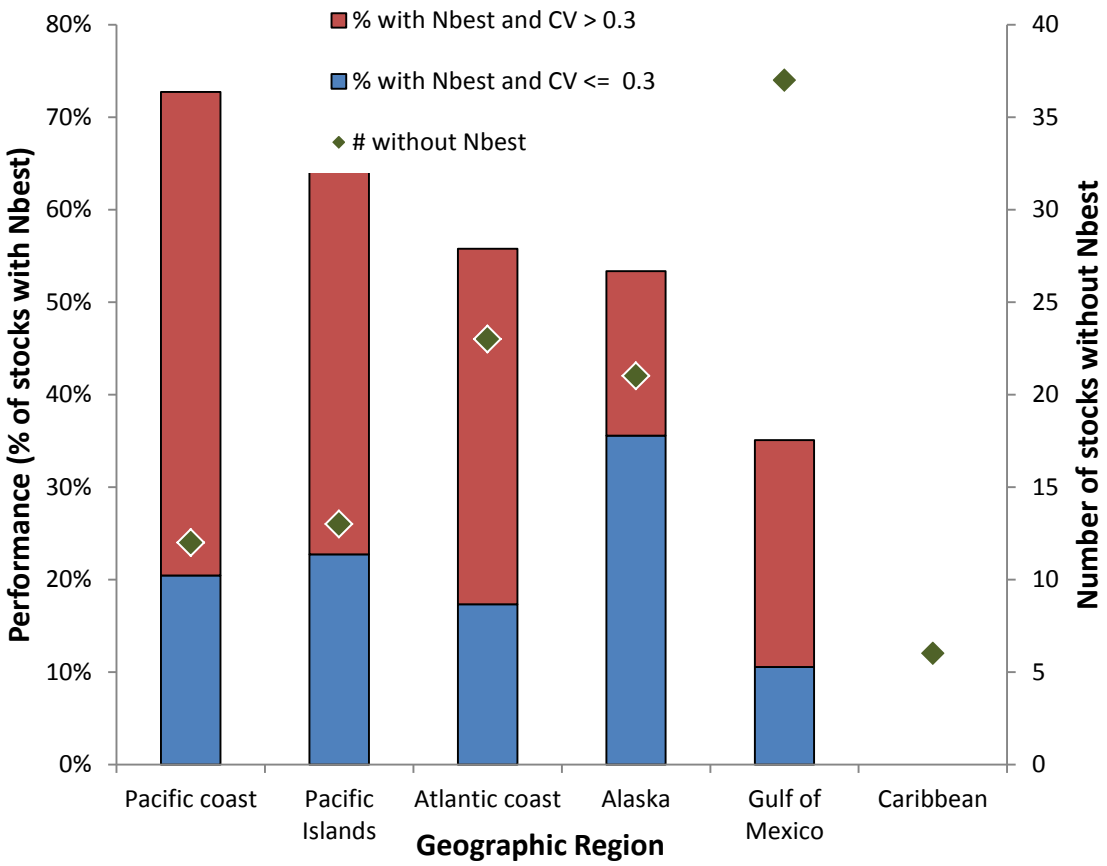


Figure 2: Performance in the 2013 assessment reports by geographic region, with regard to % of stocks for which an Nbest was provided, either with a CV(N) <= 0.3 (and therefore of reasonable precision for management purposes) or with a CV(N) > 0.3. The number of stocks without an estimate of Nbest is also presented (right axis) to illustrate what is required to reach 100% in each region, e.g., along the Atlantic coast an Nbest for another 23 stocks would result in a 100% performance.

- Stock pooling: NMFS scientists occasionally have provided a single, pooled estimate for groups of stocks of similar appearance, behavior, or natural history (e.g. beaked whales in the Atlantic, Gulf of Mexico, and Pacific regions and pygmy and dwarf sperm whales in the Atlantic and Gulf of Mexico). Pooling does not mean those stocks are of equal abundance. Indeed, this is almost certainly not the case and therefore adds a degree of bias.
- Temporal bias: Stock abundance estimates are available for many stocks but are considered by NMFS to be outdated if they are based on data that are more than eight years old—a cutoff supported by the Commission. Older data are useful for determining trends, but they are not considered reliable indicators of current abundance. The fact that abundance estimates are outdated for a number of stocks generally reflects insufficient research resources, including funding and infrastructure (e.g., vessels, aircraft), which prevents repeating surveys before eight years have elapsed. The lack of up-to-date data

for several Gulf of Mexico stocks was a major obstacle to assessing the impact to marine mammals of the 2010 Deepwater Horizon oil spill.

- Spatial bias: Abundance estimates for many stocks are based on surveys that cover only portions of their respective ranges, a form of spatial bias. If the unsurveyed areas are not representative of the surveyed areas, then abundance estimates will be systematically too high or low. Typical examples include Arctic stocks (e.g., bearded, ringed, ribbon seals), stocks that may occur in waters relatively close to shore but also occur in oceanic (pelagic or offshore) habitat, making comprehensive surveys particularly challenging (e.g., pantropical spotted, striped, rough-toothed, Clymene, Fraser's, Pacific white-sided, and Risso's dolphin), and transboundary stocks.
- Availability and perception biases: Abundance estimates also may be distorted if they are not corrected for availability or perception biases. Availability biases (not available to be seen) are more common for stocks or species with poorly understood natural history traits (e.g., diving or haulout patterns), whereas perception biases (difficult to see when available) are most severe for stocks or species that are difficult to detect at the surface (e.g., beaked whales, pygmy and dwarf sperm whales because of a low surface profile).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATE

A stock's current net productivity rate is a measure of its observed rate of increase under current conditions. Its maximum net productivity rate is a measure of its maximum potential for growth, which—in accordance with density-dependence theory—is expected to occur when a stock is at relatively low abundance. Both rates are determined by the stock's rates of reproduction and survival.

The MMPA allows NMFS scientists to use either a theoretical or an empirically estimated maximum net productivity rate for purposes of estimating a stock's tolerance for human impacts. In the 2013 assessments, empirically estimated rates were used for only 5% of stocks and theoretical (default) rates for 95%. That is to be expected for the most part because scientists rarely have an opportunity to observe a stock growing from a low abundance without impediment.

CURRENT POPULATION TREND

Marine mammals are large-bodied with low rates of reproduction and growth, many invest in extended parental care of their young, and have the capacity to live long lives. Those qualities help them cope with environmental variation but also mean that their populations are slow-growing and—depending on risk factors—can decline much faster than they can recover.

Whereas measures of a stock's abundance provide a snapshot of its status at a point in time, a stock's trend indicates changes in status over time. Whether growing, stable, or declining, a stock's trend reflects its inherent capacity for growth as affected by any relevant risk factors. Even when risk factors cannot be identified and evaluated with confidence, a declining trend in abundance may be the first indication that a stock is being exposed to one or more risk factors. Similarly, information on trends can be helpful for determining whether management efforts are achieving their conservation objectives. Some recovery plans (e.g., Steller sea lions) use positive

growth over a set period, rather than achieving a target stock abundance, as a measure of recovery.

For any given stock, the value of trend analysis depends on the length of the time series involved and the quality of the data. To evaluate NMFS efforts to assess stock trends, the Commission counted the number of 2013 stock assessment reports that provided quantitative or qualitative trend analyses. The number of quantitative trends that spanned at least 15 years and included at least some data that were not more than 8 years old was also tallied.

Of the 248 stock assessment reports, 76 (31%) contained some trend information, including 33 (13%) with a quantitative trend analysis and 43 (17%) with a qualitative description. Of the 33 quantitative analyses, 27 (11% of the total) spanned at least 15 years and included at least some data that were not more than eight years old. Results are summarized in Table 1.

Table 1. Number of stocks with quantitative trend analysis, qualitative trend analysis, or no trend analysis. Numbers in parentheses indicate the number of stocks with at least 15 years of trend data, at least some of which were less than or equal to 8 years old in 2013.

Region	Stocks	Quantitative analysis (high quality)	Qualitative analysis	No trend data
Atlantic coast	52	1 (1)	6	45
Gulf of Mexico	57	0 (0)	2	55
Pacific coast	44	16 (10)	20	8
Pacific Islands	44	2 (2)	0	42
Alaska	45	14 (14)	15	16
Caribbean	6	0 (0)	0	6
Total	**248**	**33 (27)**	**43**	**172**

Taylor et al. (2007) illustrated how inadequate trend information undermines NMFS's ability to detect stocks in trouble. Among other things, those authors—

- defined a decrease in abundance of 50% or more in 15 years as a precipitous decline;
- noted that a stock experiencing such a decline could be designated as depleted under the MMPA;
- assessed three categories of cetaceans, two categories of pinnipeds, and a category consisting of polar bears and sea otter stocks; and
- found that given information available, declines would be detected statistically for 28% of large whales, only 10% of beaked whales, 22% of dolphins/porpoises, 0% of pinnipeds breeding on ice, 95% of pinnipeds breeding on land, and 45% of polar bear/sea otter stocks.

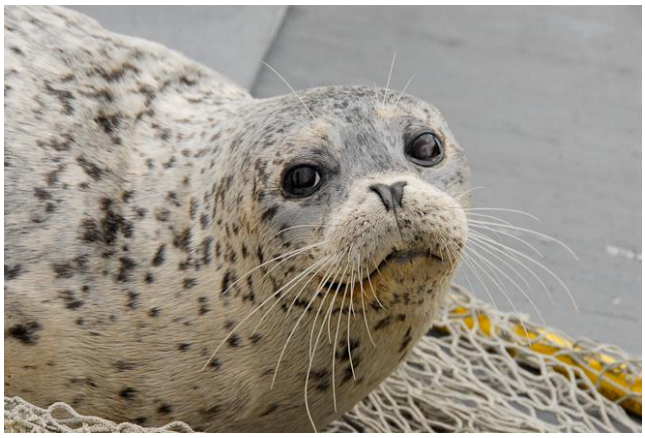
The stock assessment reports and the results of Taylor et al. (2007) indicate that, given the best scientific information currently available, the majority of marine mammal stocks could decline significantly without detection. Clearly, the ability of scientists to assess trends is influenced by marine mammal natural history (e.g., land-breeding versus ice-breeding pinnipeds; long, deep-divers such as beaked whales versus rapidly surfacing and relatively shallow divers such as

harbor porpoises), but it also is determined by the availability (or current lack thereof) of the research infrastructure (e.g., vessels, aircraft) and the resources required for field surveys/studies.

POTENTIAL BIOLOGICAL REMOVAL LEVEL

The sixth requirement of Section 117 is to estimate each stock's tolerance for human-caused mortality and serious injury, using the potential biological removal level (or PBR) metric.

IMPORTANCE



Harbor seal ready to be released. (Dave Withrow, Alaska Fisheries Science Center, NOAA Fisheries)

The MMPA established the objective of maintaining each marine mammal stock within, or returning it to, its optimum sustainable population range (OSP).[4] With that objective in mind, Congress directed NMFS to develop a stock-specific reference value for judging when direct human-caused mortality or serious injury poses an unacceptable risk of stock depletion. That threshold is called the stock's potential biological removal (PBR) level, defined as "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" (16 U.S.C. §1362.20). PBR is calculated as the product of—

(a) the minimum population estimate of the stock (N_{min});

(b) one-half the maximum theoretical or estimated net productivity rate of the stock at a small population size (R_{max}); and

(c) a recovery factor of between 0.1 and 1.0 (F_r).

Hence, PBR = N_{min} x 0.5 R_{max} x F_r.

APPLYING THE PBR CONCEPT

The PBR formulation accounts for uncertainty in a stock's abundance by using N_{min} (rather than N_{best}). It accounts for variability in the stock's tolerance of human impacts by allowing the Service to vary the recovery factor based on a stock's status (i.e., threatened, endangered, depleted), trend (i.e., increasing, stable, decreasing), and abundance relative to its optimum

[4] NMFS's implementing regulations define OSP to be the range between a stock's maximum net productivity level and its environmental carrying capacity (50 C.F.R. § 216.3).

sustainable population level (NMFS 2005). The maximum net productivity rate can be based on an empirical estimate or a theoretical value.[5]

Although the PBR concept may appear straightforward, applying it has been compromised by insufficient abundance data to calculate reliable, up-to-date PBR estimates. Of the 248 stocks evaluated, 134 (54%) had PBR estimates, 51 (21%) had outdated PBR estimates, 59 (24%) had no estimates, and the reports for 4 stocks (2%) were described as having population dynamics inconsistent with application of the PBR concept (Figures 3a and b).

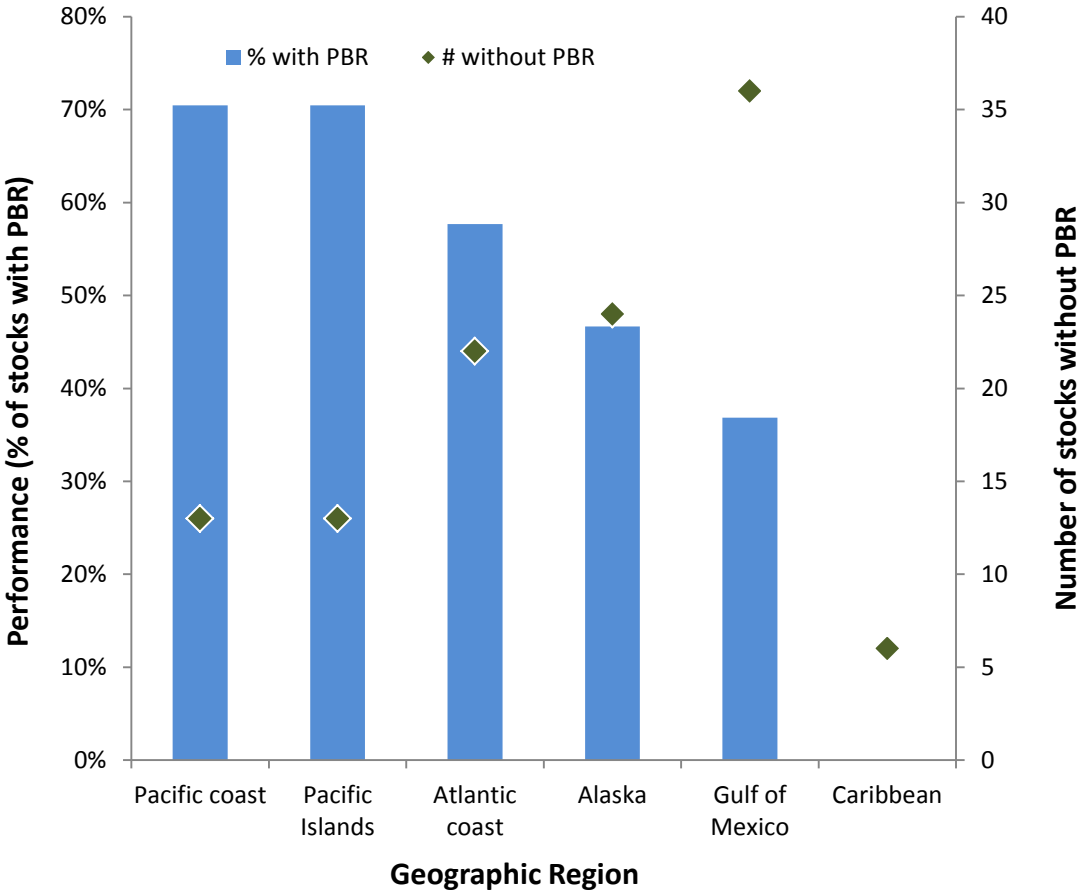


Figure 3a: Performance of NMFS in the 2013 assessment reports by geographic region, with regard to % of stocks for which a PBR estimate was provided. The number of stocks without a PBR is also presented to illustrate what is required to reach 100% in each region. For example, in the Gulf of Mexico to reach 100% performance a PBR must be estimated for an additional 36 stocks.

[5] In practice a default theoretical value that is specific to species group (cetaceans or pinnipeds) was used for most stocks in the 2013 assessments

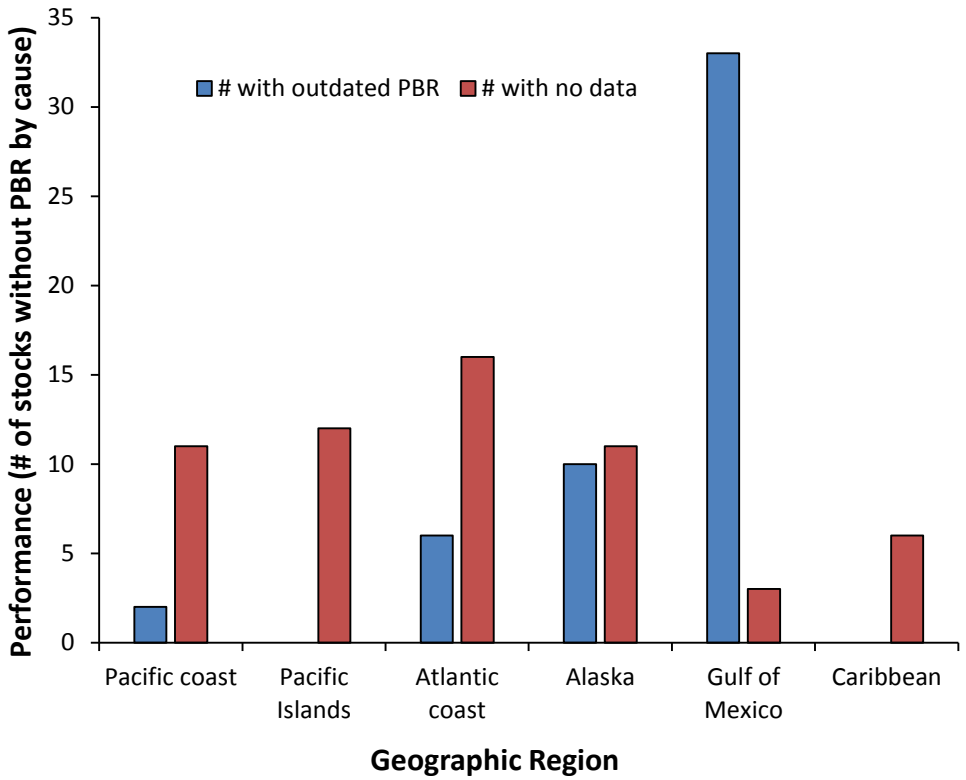


Figure 3b: Reason for the lack of a PBR estimate by geographic region. "Outdated PBR" indicates stocks that had some survey effort but those surveys are now more than eight years old and considered outdated. "No data" indicates stocks on which no significant survey effort has been focused. For example, in the Gulf of Mexico of the 36 stocks without a PBR in the 2013 assessments 33 are due to outdated survey data and 3 are due to no data.

CHALLENGES APPLYING THE PBR CONCEPT

The 2013 stock assessments indicate a number of problems that undermine the PBR approach or its application under current conditions.

1. As noted above, calculation of PBR requires an estimate of N_{min} and 110 (44%) of the 248 stocks in the 2013 stock assessments do not report an N_{min} estimate; therefore, the Service could not estimate a PBR for those stocks.
2. If NMFS has an N_{min} estimate for a stock, but the estimate is based on data older than eight years, then any PBR calculated using that N_{min} is deemed unreliable. In the next two years, ten abundance estimates will become outdated if NMFS does not have the resources to collect new abundance data.
3. Recovery factors strongly influence PBR estimates and are based in part on stock trend, but trend information is not available for 172 (69%) of the stocks.
4. A single PBR estimate for a pooled group of stocks will overestimate the tolerance for human-related effects of at least one stock in each pooled group. If this approach is to be used at all, it should be used sparingly and on a temporary basis only because such

pooling poses greater risk to pooled stocks with relatively smaller abundances, slower growth rates, greater vulnerability to human-related risk factors, or less resilience to those factors.

DISCUSSION AND RECOMMENDATIONS

The MMPA is a statement of conservation responsibility by Congress on society's behalf. It establishes a science-based framework for conserving marine mammals and the ecosystems upon which they depend. When they are complete, stock assessment reports provide a valuable basis for managing the adverse effects of human activities on marine mammals. This review indicates that although considerable progress has been made, on the whole, existing stock assessment reports fall far short of meeting the objectives set forth in the MMPA.

Three humpback whales dive together.

Of the 248 stocks in the 2013 reports NMFS provided—

- minimum estimates of abundance for only 138 stocks (56%);
- estimates of maximum productivity rates (i.e. not use a default value) for only 12 stocks (5%);
- population trend information for 76 stocks (31%), including quantitative analysis in 33 stocks(13%) and qualitative analysis in 43 stocks (17%); and
- a current potential biological removal level for only 134 stocks (54%). Of the remaining stocks 51 (21%) had outdated PBRs, 59 stocks (24%) had no PBR, and the reports for 4 stocks (2%) were described as having population dynamics inconsistent with application of the PBR concept.

Based on discussions with NMFS in regard to the shortcomings, the most obvious and prevalent problem appears to be lack of resources (funding and logistical) to support the science needed for management purposes. NMFS's staff have demonstrated that they have the capacity to do excellent scientific work, but they cannot do so if they do not have the resources needed.

Inadequate information in the stock assessment reports compromises NMFS's ability to prioritize its management and recovery actions in any meaningful or effective way. It also impedes the accurate evaluation of impacts from permitted sectors such as fisheries, energy, and defense, as well as impacts of catastrophic events such as the Deepwater Horizon Gulf Oil Spill, exposing marine mammal stocks to unnecessary risks.

The Commission therefore recommends that Congress support NMFS in its efforts to—

- improve understanding of stock structure, particularly for marine mammals in the Gulf of Mexico, central and western Pacific, and Arctic regions;
- identify and survey the ranges of marine mammal stocks to more accurately estimate abundance and distribution of stocks and hence better manage human interactions, risks of injury and mortality, and detect changes in stock status;
- implement a national stock assessment strategy that describes the infrastructure and resources needed to adequately conduct required stock assessments coordinated across regions, incorporates efforts to identify new stocks, and follows a schedule that ensures that NMFS has the status and trend information needed to identify, manage, and conserve depleted, threatened, or endangered stocks. NMFS currently undertakes some of these activities as part of its "Protected Resources Science Investment and Planning Process (PRSIPP);" [6] and
- identify and prioritize, on a national rather than regional basis and as part of the PRSIPP, those stocks for which an estimated PBR level cannot be calculated.

Specifically, the Commission recommends that Congress—

- work with leadership in NOAA, the Department of Commerce, and other Administration officials, to identify and secure the resources necessary to implement Section 117 of the MMPA and produce high quality, thorough, stock assessment reports nationally.

To improve stock assessments particular focus should be placed on vessel, ground, and aircraft surveys of the U.S. EEZ and adjacent waters conducted with consistent methodology at least twice in an eight-year period (to estimate the abundance and trends of all marine mammal stocks in U.S. waters), development of alternative survey technologies, and genetic analyses to better identify and define discrete marine mammal stocks in U.S. waters

The Commission would welcome the opportunity to discuss the results of its review with NMFS, NOAA, the Department of Commerce, the Administration, and Congress. The Commission believes that, with adequate resources, NMFS can fulfill the vision and mandates set forth in the MMPA for stock assessment.

ACKNOWLEDGMENTS

The Marine Mammal Commission would like to thank Timothy Ragen, Tiffini Brookens, Kristine Lynch, Robert Gisiner, Nina Young, and Dennis Heinemann. This report would not have been completed without your ideas, discussions, and contributions.

[6] NMFS has a proposal for conducting rotational surveys on a predictable schedule to increase efficient use of resources nationally but lacks the funding to support this initiative.

REFERENCES

Dizon, A.E., C. Lockyer, W.F. Perrin, D.P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conservation Biology 6:24-36.

Martien, K.K., A. Lang, and B.L. Taylor. 2015. Report of the meeting on the use of multiple lines of evidence to delineate demographically independent populations. NOAA-TM-NMFS-SWFSC-538, 10 pages.

National Marine Fisheries Service. 2005. Revisions to guidelines for assessing marine mammal stocks. 24 pages. Available at http://www.nmfs.noaa.gov/pr/pdfs/sars/ gamms2005.pdf.

Taylor, B.L., M. Martinez, T. Gerrodette, and J. Barlow. 2007. Lessons from monitoring trends in abundance of marine mammals. Marine Mammal Science 23(1):157–175.

Marine Mammal Commission

An independent agency of the U.S. Government

4340 East-West Highway | Room 700 | Bethesda, MD 20814

www.mmc.gov