

**A COMPARATIVE ANALYSIS OF THE STATUS OF THE U.S.
MARINE MAMMAL STOCK ASSESSMENT PROGRAM**

by

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EXECUTIVE SUMMARY

The Marine Mammal Protection Act (MMPA) includes a multi-step process for reducing national marine mammal bycatch. This process requires the National Marine Fisheries Service (NMFS) to publish annual marine mammal Stock Assessment Reports (SARs), which include best estimates of each stock's abundance, population trend, maximum rate of increase, potential biological removal (PBR), and 'annual human-caused mortality and serious injury'. On the basis of these estimates, NMFS determines 'strategic' stocks which are most at risk from bycatch. According to the MMPA, a stock should be considered strategic if is: a) Threatened or Endangered under the ESA, or decreasing in abundance and likely to be listed, or b) classified as depleted under the MMPA, or c) experiencing direct human-caused mortality and serious injury at a level which exceeds its PBR.

If strategic stocks interact with commercial fisheries that have significant levels of marine mammal bycatch, the agency is required to establish Take Reduction Teams (TRTs), which craft Take Reduction Plans (TRPs). TRPs include measures to reduce the fishery-related mortality of a particular strategic stock, given that the current level of annual human-caused mortality and serious injury exceeds the stock's PBR. Therefore, without a TRT, the strategic stocks interacting with fisheries that cause either frequent or occasional mortality will continue to remain imperiled because nothing is being done to reduce the unsustainable level of stock mortality. Because NMFS' status determinations are data-dependent, deficient and/or imprecise stock data hinders the agency's ability to appropriately determine strategic status.

This project assessed the current state of the U.S. marine mammal stock assessment program, with regard to data quality and MMPA compliance, relative to previous assessments by NMFS (2004) and the GAO (2008). NMFS (2004) concluded that the agency had inadequate funding to meet the MMPA mandates, and as a result, 81% of stocks in the 2002 SARs were deficient in abundance estimates, and/or fishery-related mortality estimates, and/or stock identification, and/or assessment frequency and quality. These stocks were said to be at 'Tier 1' status, while 'Tier 2' status, characterized by adequate information in the aforementioned categories, was necessary to meet legislative mandates. Optimistically, NMFS predicted that the agency would acquire adequate funding for the program by 2010, and move most stocks to Tier 2 status within an additional 5-10 years.

In 2008, the Government Accountability Office (GAO) published a follow-up analysis of the marine mammal stock assessment program. This analysis uncovered a high incidence of missing, imprecise, and outdated stock information within the 2007 SARs. GAO cautioned that NMFS' reliance on inadequate data could cause the agency to incorrectly identify marine mammal stocks requiring TRTs. GAO also identified 14 marine mammal stocks meeting those requirements for which no TRT had been established. For TRTs which had been established, GAO discovered that the MMPA mandated TRT deadlines had often been missed. When a team misses deadlines, there is an associated delay in implementing the measures designed to reduce fishery-related mortality of the managed stock, which means it will continue to be in jeopardy. Additionally, GAO found that TRTs had no comprehensive monitoring strategies to assess the effectiveness of implemented measures.

The aim of this project was to repeat the methodologies of the former analyses to evaluate the current status of the program. To accomplish this task, stock data was extracted from the 2013 SARs for the three recognized U.S. regions (Atlantic / Gulf of Mexico (GOM), Pacific, and Alaska) and compiled into an Excel database for examination of data quality. The compiled data were then used

to determine whether all stocks requiring TRTs have had TRTs established. Additionally, TRT webpages, available as links on NMFS's main Marine Mammal Take Reduction Team webpage, were consulted to determine if deadlines have been met for any TRTs established post-2008. TRT webpages were also consulted to determine whether TRTs have developed comprehensive plans to measure success of TRPs. Finally, by assessing the compiled stock data relative to the ranking system used by NMFS (2004), all stocks within the 2013 SARs were categorized as being at either Tier 1 or Tier 2 status.

The key findings of this project are:

- out of 217 identified stocks, 34 stocks (16%) have outdated abundance estimates
- 110 out of 217 stocks (51%) have abundance estimates that are either imprecise or of unknown precision
- 110 out of 217 stocks (51%) have inadequate stock structure information
- 176 out of 217 stocks (81%) have unknown population trends
- 197 out of 217 stocks (91%) have unknown maximum reproductive rates
- 45 out of 217 stocks (21%) have unknown values of annual human-caused mortality
- 84 out of 217 stocks (39%) have estimates of human-caused mortality that are either imprecise or of unknown precision
- 67 out of 217 stocks (31%) have unknown values for potential biological removal
- 15 stocks meeting the requirement for a TRT have not had a TRT established
- Only 1 TRT, for false killer whales in Hawaii, has been established post-2008, and it has missed 3 out of the 5 MMPA mandated deadlines
- 4 out of 7 TRTs have developed comprehensive monitoring plans to assess TRPs
- 178 out of 217 stocks (82%) remain at Tier 1 status.

The results of this project indicate that significant data gaps remain within the U.S. marine mammal stock assessment program. For multiple facets of the program, including TRT formation, TRT deadlines, and Tier status, NMFS is out of compliance with the MMPA. In light of these deficiencies, I recommend NMFS reevaluate the program and determine how to better prioritize its resources.

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INTRODUCTION

The operations of commercial fisheries worldwide can result in the unintended lethal or seriously injurious capture of non-targeted marine organisms. This phenomenon, known as bycatch, is recognized as the biggest global threat to marine mammals (U.S. Commission on Ocean Policy, 2004). The National Marine Fisheries Service (NMFS) estimates that in 2013 alone, more than 3,000 marine mammals were bycaught in U.S. commercial fisheries (NMFS, 2013b). As fisheries continue to expand and intensify to meet the protein requirements of the world's growing human population, there is a predicted increasing likelihood of interactions between marine mammals and fishing gear (Read, 2006). To address this threat, the 1994 Amendments to the Marine Mammal Protection Act (MMPA (16 U.S.C. §1371)) outlined a targeted procedure for reducing and ultimately eliminating marine mammal bycatch in the United States. This procedure requires the National Marine Fisheries Service (NMFS) to regularly survey marine mammal populations, or stocks, and compile the results of those surveys into annual marine mammal Stock Assessment Reports, or SARs. Included in these reports are NMFS' best estimates of total and minimum abundance, the population trend, the stock's maximum rate of increase, and the total 'annual human-caused mortality and serious injury' for each recognized U.S. stock of marine mammals. On the basis of these estimates, NMFS determines each stock's potential biological removal (PBR), which is 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" [MMPA Section 3 (20)]. Finally, NMFS must use the available information to classify each stock as either 'strategic' or 'non-strategic,' wherein strategic stocks are recognized to be those most at risk from bycatch.

According to the 1994 Amendments to the MMPA, a stock must be classified as strategic if it is: a) Threatened or Endangered under the ESA, or decreasing in abundance and likely to be listed, or b) classified as depleted under the MMPA, or c) experiencing direct human-caused mortality and serious injury at a level which exceeds its PBR. Estimates of annual human-caused mortality and serious injury are derived from records of mortality and serious injury caused by various human activities, including U.S. commercial fishing, other fishing, vessel strikes, and subsistence harvests (GAO, 2008). The estimates of commercial fishery-related mortality and

serious injury are primarily obtained from reports of independent fishery observers employed by NMFS' National Observer Program (NMFS, 2013b). Pursuant to the 1994 MMPA Amendments, NMFS has an additional mandate of establishing Take Reduction Teams (TRTs) for strategic stocks which are known to be interacting with commercial fisheries that cause either frequent or occasional marine mammal bycatch (these are Category 1 and Category 2 fisheries, respectively) (NOAA Fisheries Office of Protected Resources, 2014). TRTs, which are multi-stakeholder, consensus-based, and subject to precise deadlines, are responsible for developing Take Reduction Plans (TRPs) for implementing measures to ultimately eliminate the bycatch of strategic stocks.

Because a stock's calculated PBR is directly dependent on estimates of minimum stock abundance and the stock's predicted maximum rate of increase, deficient and/or imprecise stock data hinders NMFS' ability to appropriately determine strategic status based on a level of human-caused mortality and serious injury which exceeds PBR. Likewise, the accuracy of each stock's estimated annual human-caused mortality and serious injury is reliant upon the quality of data obtained from observers and other sources. Yet, in a 2004 report, NMFS states that "frequently, the agency's actions are found [by courts] to be 'arbitrary and capricious' owing to the reality that the 'best available' information on protected species is insufficient," and accordingly, acknowledges a "need for greater accuracy and precision of scientific information" (NMFS, 2004). In response to this reality, the same report, entitled "A Requirements Plan for Improving the Understanding of the Status of U.S. Protected Marine Species," examines the state of NMFS' stock assessment program relative to legal mandates, and identifies the additional resources needed to bring the program into full compliance.

According to the report, NMFS has "insufficient resources to meet legislative mandates" for the stock assessment program (p. 8). As a result, of the 165 stocks identified in the 2002 SARs, 134 stocks were lacking adequate information on abundance, and/or fishery-related mortality, and/or stock identification, and/or assessment frequency and quality. These stocks were said to be at 'Tier 1' status, while 'Tier 2' status, characterized by sufficient information in the aforementioned categories, was necessary to meet legislative mandates. In order to achieve Tier 2 status for all stocks, NMFS identified the following primary additional resource requirements: additional staff (120 FTE and 386 contract); expansion of observer program to

sample all fisheries with marine mammal interactions; and expansion of population survey effort (705 additional sea days and 900 additional flight hours) (NMFS, 2004, p. ix). According to this analysis, data quality improvements were needed in “five data categories (stock identification, abundance, fishery mortality, and assessment frequency and quality),” with stock identification identified as the category most in need of improvement (101 stocks [61%] deficient in stock identification) (p. 24). Optimistically, NMFS predicted that the agency would acquire full funding to obtain necessary additional resources by 2010, and that “most species [would] be moved to Tier 2” within another 5-10 years (p. 59).

A follow-up report on the status of NMFS’ stock assessment program was published by the Government Accountability Office (GAO) in 2008. This comprehensive analysis identified significant gaps in available data for a majority of stocks identified in the 2007 SARs. For example, 39 of 113 (34.5%) stocks¹ lacked estimates of either human-caused mortality and serious injury or PBR, preventing strategic determination, while the remaining 74 stocks contained data of questionable accuracy (p. 6). For at least 11 of the 74 stocks (estimated), PBR determinations were based on abundance estimates that were 8 years old or older, despite scientific knowledge that marine mammal stocks have the potential to decline significantly within an 8-year time-frame (p. 18). An additional 21 of the 74 stocks (estimated) utilized abundance estimates that were between 5 and 8 years old, even though “a 2004 NMFS report to Congress stated that estimates for population size based on information 5 years old or older may not accurately represent a marine mammal stock’s current population size” (GAO, 2008, p. 18). Additionally, GAO’s analysis repeatedly identified estimates of abundance and fishery-related mortality that lacked the recommended precision (a coefficient of variation less than 30 percent) specified by NMFS. GAO cautioned that NMFS’ reliance on insufficient and or imprecise data could cause the agency to incorrectly identify marine mammal stocks requiring TRTs as per the 1994 MMPA Amendments guidelines.

In its analysis of SARs, GAO identified 14 marine mammal stocks meeting the statutory requirements for establishment of a TRT, for which no TRT had been established. Most

¹ GAO identified 156 stocks in the 2007 SARs, but conducted its analysis on only the 113 stocks not covered by a TRT or automatically designated as strategic because of ESA or MMPA listing. Of the 74 stocks containing both estimates of PBR and annual human-caused mortality and serious injury, “a stratified random sample of 28 stocks” was analyzed, with results extrapolated to estimate data quality for all 74 stocks (GAO, 2008, p. 18).

significantly, the Hawaiian stock of false killer whales was identified as having met the requirements for a TRT since 2004, but NMFS had not created the TRT, citing insufficient funding as the cause (GAO, 2008, p. 7). For the five TRTs subject to deadlines (6 TRTs total), most deadlines, including the deadlines for team establishment (3 of 5 teams) and for TRP publication (2 of 5 teams), were not met. Finally, GAO urged NMFS to “develop a comprehensive strategy for assessing the effectiveness of each take reduction plan and implementing regulations” (p. 9). Without such plans in place, GAO cautioned, NMFS would be unable to fully determine the success of implemented regulations.

It has been 11-years since NMFS published its ‘requirements plan’ examination of the U.S. marine mammal stock assessment program, and 7-years since GAO published its follow-up report. This project aims to repeat the former analyses to identify the current status of the program and any improvements made in line with earlier recommendations. Specifically, this project will: 1) identify current data gaps (including missing, outdated, and imprecise estimates), 2) determine whether TRTs have been established for all stocks meeting MMPA requirements, 3) determine whether deadlines have been met for any TRTs established post-2008 (GAO report), 4) determine if NMFS has developed comprehensive strategies for assessing TRP effectiveness, 5) classify stocks according to NMFS’ Tier 1/Tier 2 scheme.

METHODS

As this project aims to assess the current status of the U.S. marine mammal stock assessment program relative to previous assessments (by NMFS (2004) and GAO (2008)), I aim to duplicate, so far as possible, the methodology outlined in those assessments. Accordingly:

For Goal 1) Identifying Current Data Gaps

Data on marine mammal stocks will be extracted from the 2013 SARs, which are the most recent available, and compiled in an Excel database for analysis of data quality. This process will involve determining, for each of the three recognized U.S. regions (Atlantic / Gulf of Mexico (GOM), Pacific, and Alaska), the quantity of stocks:

- overall
- with assessments updated in 2013
- designated Strategic

- with best abundance estimates that are between 5 and 8 years old¹
- with best abundance estimates that are 8 or more years old
- lacking the recommended precision for abundance estimates
- lacking sufficient information on stock identification/structure
- lacking data on population trends
- lacking data on maximum net productivity (maximum reproductive rate)
- lacking estimates of human-caused mortality and serious injury
- lacking the recommended precision for human-caused mortality and serious injury estimates
- lacking estimates of PBR

This portion of the analysis will also draw upon accuracy-related qualitative information found within the SARs (as per GAO (2008) methods).

For Goal 2) Determining if Required TRTs have been established

Per the 1994 Amendments to the MMPA, NMFS must create a TRT team within 30 days after a SAR classifies a stock as strategic *if* the most recent list of U.S. fisheries indicates that the stock is interacting with a Category 1 or Category 2 Fishery. Accordingly, meeting this project goal will involve: 1) examining the compilation of SAR-extracted data to isolate stocks with strategic status, 2) consulting the 2014 List of Fisheries (published on March 14, 2014 by NOAA Fisheries Office of Protected Resources) to further isolate strategic stocks interacting with Category 1 and/or Category 2 Fisheries, 3) consulting the list (NMFS’ “TRT Factsheet”) of species covered by current TRTs to identify gaps in TRT coverage.

For Goal 3) Determining if deadlines have been met for any TRTs established post-2008

The TRT Factsheet and NMFS’ Marine Mammal Take Reduction Team webpage (<http://www.nmfs.noaa.gov/pr/interactions/trt/teams.htm>) will be consulted to identify currently-existing TRTs. This list will be compared to the list of TRTs published in GAO’s 2008 report to identify any teams created after GAO’s assessment. Take Reduction Team webpages, available as links on NMFS’ main Marine Mammal Take Reduction Team webpage, will then be

¹ Importantly, in determining the age of abundance estimates, I have factored in a 2-year lag-time (thus using 2011 as the baseline for the 2013 SARs), in consideration of the lengthy amount of time required to process abundance estimates and publish the SARs. GAO (2008) did not specify a lag-time or baseline for determining this variable.

consulted and given dates of action will be compared to MMPA-specified deadlines to assess this goal.

For Goal 4) Determining if NMFS has developed strategies to assess TRP effectiveness

Take Reduction Team webpages, available as links on NMFS' main Marine Mammal Take Reduction Team webpage (<http://www.nmfs.noaa.gov/pr/interactions/trt/teams.htm>), will be consulted to determine if any teams have formulated comprehensive strategies for evaluating the effectiveness of TRPs.

For Goal 5) Classifying stocks according to NMFS Tier 1/Tier 2 scheme

The process for classifying stocks according to Tier 1 or Tier 2 status was outlined in NMFS' (2004) 'Requirements Plan'. The classification scheme relies on a hierarchical ranking system of the following key SAR data categories (as determined by NMFS): Stock Id/Structure, Abundance, Anthropogenic Impacts (human-caused mortality and serious injury), Assessment Quality, and Assessment Frequency. Following the methods of NMFS' (2004) 'Requirements Plan', "for each data category identified, an evaluation [will be] conducted of the quality of knowledge for that category and a rank assigned from 0 to 4, with 0 being the lowest level of knowledge (no data) and 4 the highest level" (NMFS, 2004, p. 17). Table 1, on the following page, provides simple definitions of ranks (levels) for each of the identified categories.

NMFS (2004) categorized non-strategic stocks as Tier 1 unless a ranking of at least 2 was obtained for each of the aforementioned categories, in which case the stock could be considered Tier 2. Strategic stocks were categorized as Tier 1 unless a ranking of at least 3 was obtained for each of the categories, in which case the stock could be considered Tier 2. This project will follow the same classification determination scheme. Importantly, Tier 2 is the stock level which NMFS considers necessary to meet the legislative mandates for stock assessment.

Table 1. Definitions of hierarchical ranks (levels) for each* of the key data categories identified by NMFS (2004).

Category	Level	Level Description
Stock ID		
	0	No information (qualitative or otherwise) available
	1	Structure inferred from analyses undertaken for other purposes (e.g. distribution, differences in trends, differences in life history)
	2	Structure inferred from an analysis specifically aimed at investigating population differentiation (e.g., pollutants, stable isotopes, genetics, tagging)
	3	Structure inferred from an integrative analysis of at least two lines of evidence of the type listed under level 2
	4	Estimates of dispersal rate that include estimates of uncertainty
Abundance		
	0	No information (qualitative or otherwise) available
	1	Minimum estimate
	2	Imprecise and/or infrequent surveys
	3	Precise, frequent survey(s) with size/age composition
	4	Habitat and season specific surveys
Anthropogenic Impacts		
	0	No information (qualitative or otherwise) available
	1	Qualitative evidence (anthropogenic impacts)
	2	Minimum estimate (anthropogenic impacts)
	3	Unbiased estimates (anthropogenic impacts)
	4	Precise estimates, or no evidence of other human related mortality
Assessment Quality		
	0	None
	1	Assessment with minimum abundance/index only
	2	Assessment with simple deterministic models
	3	Assessment with advanced deterministic models
	4	Assessment with stochastic models
Assessment Frequency		
	0	Never
	1	Most recent \geq 10 years
	2	Most recent 6-9 years
	3	Most recent 2-5 years
	4	Most recent \leq 1 year

Source: NMFS. 2004. A requirements plan for improving the understanding of protected marine species. Report of the NOAA Fisheries National Task Force for improving marine mammal and turtle stock assessments. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-63, p. 18.

For the purposes of this analysis, Assessment Frequency is defined as the frequency of population surveys. The definition of this category was a source of regional inconsistency within the 2004 NMFS 'requirements plan'.

*The "Life History" category, which applies to sea turtles only, was excluded from the above table since this project is only concerned with the status of the marine mammal stock assessment program.

RESULTS

For Goal 1) Identifying Current Data Gaps

The compilation of stock-specific data, extracted from the 2013 SARs, revealed persistent gaps in available stock information across all categories that had been identified in NMFS (2004) and GAO (2008). The following tables display key findings from this portion of the analysis (calculated percentages have been rounded up to the nearest whole percent).

Table 2. Summary of Stocks in the 2013 Stock Assessment Reports

RECOGNIZED STOCKS				
	OVERALL	UPDATED IN 2013	UNKNOWN STATUS	STRATEGIC
ATLANTIC/ GOM	87	46	0	35
PACIFIC	85	59	3	18
ALASKA	45	25	0	16
TOTAL	217	130	3	69

The 2013 SARs contain stock assessments for a total of 217 stocks. Of the 69 stocks which have been designated strategic, 41 stocks received the designation automatically because they have been recognized as either “threatened” or “endangered” under the Endangered Species Act and therefore as “depleted” under the MMPA (this includes 13 stocks in the Atlantic/GOM region, 15 stocks in the Pacific Region, and 13 stocks in the Alaska region). For the remaining 22 strategic stocks, NMFS has made the classification because “the level of direct human-caused mortality exceeds the potential biological removal level,” or because the stocks are “declining and...likely to be listed as a threatened species under the Endangered Species Act” [MMPA Section 3 (19) ((A),(B))]. For 3 stocks in the Pacific region, NMFS has not made a status determination¹.

¹ The 3 stocks with UNKNOWN status are: False Killer Whale (American Samoa), Spinner Dolphin (American Samoa), Rough-Toothed Dolphin (American Samoa). NMFS lacks the necessary data to calculate estimates of abundance, population trend, and annual human-caused mortality and serious injury for these stocks. However, “the MMPA requires a determination of a stock’s status as being either strategic or non-strategic and does not specify a category of unknown”; in such cases where significant information is lacking, NMFS is instructed to use its best judgment to make a status determination (Moore & Merrick, 2011, p. 30).

Table 3. Stocks Featuring Outdated Best Abundance Estimates

ABUNDANCE ESTIMATES THAT ARE 6-7 YEARS OLD			ABUNDANCE ESTIMATES THAT ARE 8 OR MORE YEARS OLD		
	OVERALL	STRATEGIC		OVERALL	STRATEGIC
ATLANTIC/GOM	3* (3%)	0	ATLANTIC/GOM	5* (6%)	3* (9%)
PACIFIC	5 (6%)	0	PACIFIC	7* (8%)	1 (6%)
ALASKA	4 (9%)	1 (6%)	ALASKA	10 (22%)	3 (19%)
TOTAL	12 (6%)	1 (1%)	TOTAL	22 (10%)	7 (10%)

According to “a 2004 NMFS report to Congress...estimates for population size based on information 5 years old or older may not accurately represent a marine mammal stock’s current population size” (GAO, 2008, p. 18). Such outdated abundance estimates are present in the 2013 SARs for all regions, but are especially prevalent in Alaska. NMFS has recognized that marine mammal populations have the potential to decline by as much as 10% per year, which means a population could be reduced by 50% in only 8 years (Moore & Merrick, 2011, p. 75). The reliance on best abundance estimates that are 8 or more years old is therefore especially concerning given that NMFS uses stock minimum abundance to calculate PBR, and in turn uses the ratio of PBR to annual human-caused mortality and serious injury to determine status. Although all of the stocks reported in Table 3 feature best abundance estimates that are outdated, NMFS has in some cases (marked with an *) recognized the inaccuracy of reporting these estimates, and has instead reported the values as “unknown.” Of the figures marked with an * above, 2 of 3 stocks in Atlantic/GOM (6-7 years old), 5 of 7 stocks in Pacific (8 or more years old), and all remaining marked stocks, have abundance reported as “unknown.” If an outdated abundance estimate is converted to an unknown abundance estimate, NMFS will not use the figure to calculate PBR and thereby determine status. However, in such cases, NMFS continues to have poor information about the abundance of relevant stocks due to outdated best estimates. The agency will therefore be unable to assess the impact of annual human-caused mortality and serious injury.

Table 4. Stocks with Imprecise Abundance Estimates

ABUNDANCE ESTIMATES LACKING RECOMMENDED PRECISION		
	OVERALL	STRATEGIC
ATLANTIC/GOM	43 (49%)	9 (26%)
PACIFIC	41 (48%)	9 (50%)
ALASKA	0	0
TOTAL	84 (39%)	18 (26%)

For each abundance estimate within the 2013 SARs, “NMFS calculates precision by identifying a coefficient of variation (CV)” (GAO, 2008, p. 19). The agency uses a cutoff of 30 percent to delineate precision, wherein “estimates with CVs greater than 30 percent are less precise” than what is considered “appropriate for determining strategic status” (GAO, 2008, p.19). The values reported in Table 4 represent stocks which have best abundance estimates with a CV of 30% or more. Due to imprecision, these abundance estimates may not reflect true abundance, yet the estimates are still used in calculations of PBR. .

Table 5. Stocks with Unknown Precision for Abundance Estimates

ABUNDANCE ESTIMATES WITH UNKNOWN PRECISION		
	OVERALL	STRATEGIC
ATLANTIC/GOM	3 (3%)	2 (6%)
PACIFIC	11 (13%)	5 (28%)
ALASKA	12 (27%)	4 (25%)
TOTAL	26 (12%)	11 (17%)

Within the 2013 SARs, there are stocks which lack a CV for abundance, and thus have no measure of precision. The values reported in Table 5 represent those stocks which have best abundance estimates with unknown precision. For these stocks, NMFS has no means of determining whether reported abundance estimates reflect true stock abundance, yet the estimates are still used in calculations of PBR.

Table 6. Stocks with Inadequate Stock Structure Information

INADEQUATE STOCK STRUCTURE INFORMATION		
	OVERALL	STRATEGIC
ATLANTIC/GOM	58 (67%)	11 (31%)
PACIFIC	37 (44%)	8 (44%)
ALASKA	15 (33%)	8 (50%)
TOTAL	110 (51%)	27 (39%)

The values reported in Table 6 represent stocks for which there is inadequate information available to accurately delineate stock structure. As a result, these stocks may in fact be composed of multiple smaller stocks, or may instead be integrated into a larger stock. Given this uncertainty, estimates of abundance and annual human-caused mortality and serious injury may be highly inaccurate, and therefore may lead to incorrect determination of stock status.

Table 7. Stocks with an Unknown Population Trend

UNKNOWN POPULATION TREND		
	OVERALL	STRATEGIC
ATLANTIC/GOM	83 (95%)	33 (94%)
PACIFIC	63 (74%)	9 (50%)
ALASKA	30 (67%)	7 (44%)
TOTAL	176 (81%)	49 (71%)

The values reported in Table 7 represent stocks for which there is insufficient information available to determine population trend. NMFS must designate a stock as strategic when it is known to be declining at a rate which would predict its being added to the ESA within the near future. However, NMFS is unable to make this determination when stocks' population trends are unknown.

Table 8. Stocks with an Unknown Maximum Reproductive Rate

UNKNOWN MAXIMUM REPRODUCTIVE RATE		
	OVERALL	STRATEGIC
ATLANTIC/GOM	85 (98%)	33 (94%)
PACIFIC	73 (86%)	12 (75%)
ALASKA	39 (87%)	12 (75%)
TOTAL	197 (91%)	57 (83%)

The values reported in Table 8 represent stocks for which there is insufficient information available to determine maximum reproductive rates (R_{Max}). R_{Max} is used to calculate PBR, so in cases where stock-specific values are unknown, NMFS employs default theoretical values (R_{Max} of 4% for cetaceans and R_{Max} of 12% for pinnipeds) (Wade and Angliss 1997). Real but unknown values of R_{Max} for stocks may differ from theoretical values, which can affect the accuracy of PBR calculations.

Table 9. Stocks with Unknown Annual Human-Caused Mortality and Serious Injury

NO ESTIMATE OF HUMAN-CAUSED MORTALITY AND SERIOUS INJURY		
	OVERALL	STRATEGIC
ATLANTIC/GOM	28 (32%)	23 (66%)
PACIFIC	17 (20%)	0
ALASKA	0	0
TOTAL	45 (21%)	23 (33%)

The values reported in Table 9 represent stocks for which there is no estimate of annual human-caused mortality and serious injury. Without this information, NMFS has no means of determining whether human-caused mortality and serious injury is exceeding a stock's PBR, in which case the stock qualifies for strategic status.

Table 10. Stocks with Imprecise Human-Caused Mortality and Serious Injury Estimates

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY ESTIMATES LACKING RECOMMENDED PRECISION		
	OVERALL	STRATEGIC
ATLANTIC/GOM	7 (8%)	0
PACIFIC	11 (13%)	4 (22%)
ALASKA	17 (38%)	4 (25%)
TOTAL	35 (16%)	8 (12%)

For each estimate of annual human-caused mortality and serious injury within the 2013 SARs, “NMFS calculates precision by identifying a coefficient of variation (CV)” (GAO, 2008, p. 19). The agency uses a cutoff of 30 percent to delineate precision, wherein “estimates with CVs greater than 30 percent are less precise” than what is considered “appropriate for determining strategic status” (GAO, 2008, p.19). The values reported in Table 10 represent stocks which have human-caused mortality and serious injury estimates with a CV of 30% or more. Due to imprecision, these estimates may not reflect true human-caused mortality and serious injury, yet the estimates are still considered in comparison to PBR to determine stock status.

Table 11. Stocks with Unknown Precision for Human-Caused Mortality and Serious Injury

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY ESTIMATES WITH UNKNOWN PRECISION		
	OVERALL	STRATEGIC
ATLANTIC/GOM	15 (17%)	12 (34%)
PACIFIC	24 (28%)	4 (22%)
ALASKA	10 (22%)	6 (38%)
TOTAL	49 (23%)	22 (32%)

Within the 2013 SARs, there are stocks which lack a CV for annual human-caused mortality and serious injury, and thus have no measure of precision. The values reported in Table 11 represent those stocks which have human-caused mortality and serious injury estimates with unknown precision. For these stocks, NMFS has no means of determining whether reported estimates reflect true human-caused mortality and serious injury, yet the estimates are still considered in comparison to PBR to determine stock status.

Table 12. Stocks with Unknown Potential Biological Removal

UNKNOWN PBR		
	OVERALL	STRATEGIC
ATLANTIC/GOM	29 (33%)	14 (40%)
PACIFIC	18 (21%)	1 (6%)
ALASKA	20 (44%)	8 (50%)
TOTAL	67 (31%)	23 (33%)

The values reported in Table 12 represent stocks for which there is no estimate of PBR. Without this information, NMFS has no means of determining whether human-caused mortality and serious injury is exceeding a stock's PBR, in which case the stock qualifies for strategic status.

For Goal 2) Determining if Required TRTs have been established

Table 13. Stocks that qualify for TRT formation but do not have TRTs

Region of Stock Assessment	Number of Stocks qualifying for a TRT <i>without</i> a TRT formed	Stock Names
Atlantic / Gulf of Mexico	2	1) *Common Bottlenose Dolphin- Gulf of Mexico bay, sound, and estuary** 2) Sperm Whale- Gulf of Mexico
Pacific	2	1) Sea Otter- Southern 2) Humpback Whale- California/Oregon/Washington
Alaska	11	1) Harbor Porpoise- Southeast Alaska** 2) Harbor Porpoise- Bering Sea** 3) Harbor Porpoise- Gulf of Alaska** 4) Bearded Seal- Alaska 5) Ringed Seal- Alaska 6) Steller Sea Lion- Western U.S.** 7) Steller Sea Lion- Eastern U.S.** 8) Northern Fur Seal- Eastern North Pacific** 9) Beluga Whale- Cook Inlet 10) Humpback Whale- Western North Pacific** 11) Humpback Whale- Central North Pacific**
OVERALL	15 STOCKS QUALIFYING FOR A TRT HAVE NOT HAD A TRT FORMED	
<p><i>*The Common Bottlenose Dolphin- Gulf of Mexico bay, sound, and estuary stock is actually a compilation of 29 stocks that are represented by one Stock Assessment Report within the 2013 SARs. This stock compilation has been reported as one stock to maintain consistency with the findings of GAO (2008).</i></p> <p><i>** These stocks were previously identified as meeting the requirements for a TRT yet lacking a TRT by GAO in its 2008 report.</i></p> <p><i>NOTE: The Humpback Whale-California/Oregon/Washington stock is covered by the Pacific Offshore Cetacean TRT to address the stock's interactions with the Category 1 CA thresher shark/ swordfish drift gillnet fishery. However, there is no TRT coverage to mitigate interactions with the Category 2 CA halibut/ white seabass and other species set gillnet fishery or with five Category 2 crab pot fisheries.</i></p>		

For Goal 3) Determining if deadlines have been met for any TRTs established post-2008

The only new TRT established since the 2008 GAO report is the False Killer Whale (Hawaii) Take Reduction Team. The table below shows the extent to which deadlines have been met for this team.

Table 14. Extent to which TRT deadlines have been met

MMPA DEADLINES FOR TRTs	FALSE KILLER WHALE (Hawaii) TRT	DEADLINE MISSED BY
<ul style="list-style-type: none"> • NMFS must establish a take reduction team within 30 days after a final stock assessment report indicates that a stock is strategic and it is listed in the current List of Fisheries as interacting with a Category I or II fishery. • Take reduction team members must develop a draft plan and submit the plan to NMFS within 6 months after the take reduction team is established. • NMFS must publish a proposed take reduction plan in the <i>Federal Register</i> within 60 days of receiving the team’s draft plan. • NMFS must hold a public comment period on the proposed take reduction plan for up to 90 days after its publication. • NMFS must publish a final take reduction plan in the <i>Federal Register</i> within 60 days after the public comment period on the proposed plan ends. 	<ul style="list-style-type: none"> • Hawaiian stocks of False Killer Whales have met MMPA’s requirements for establishing a TRT since 2004 <ul style="list-style-type: none"> • <i>TRT est. January 19, 2010</i> • Draft plan submitted to NMFS on July 19, 2010 • <i>NMFS published a proposed rule to implement the Plan on July 18, 2011.</i> • The public comment period for the proposed rule closed on October 17, 2011. • <i>NMFS published a Final Rule to implement the plan on November 29, 2012.</i> 	<ul style="list-style-type: none"> • 6 Years • Deadline Met • 10 Months • Deadline Met • 11 Months and 12 days
<p><i>The above TRT deadlines are described in [MMPA Section 118 (f) (7)].</i></p>		

For Goal 4) Determining if NMFS has developed plans to assess TRP effectiveness

<ul style="list-style-type: none"> ● Four out of Seven TRTs now have TRP monitoring plans:
<ul style="list-style-type: none"> ● Harbor Porpoise (published in 2010) ● Atlantic Large Whale (published in 2012) ● Atlantic Trawl Gear (published in 2012) ● False Killer Whale (published in 2014)
<ul style="list-style-type: none"> ● Three out of Seven TRTs remain without TRP monitoring plans:
<ul style="list-style-type: none"> ● Bottlenose Dolphin ● Pacific Offshore Cetacean ● Pelagic Longline

For Goal 5) Classifying stocks according to NMFS Tier 1/Tier 2 scheme

Table 15. Number of stocks remaining at Tier 1 status

STOCKS REMAINING AT TIER 1 STATUS		
	OVERALL	STRATEGIC
ATLANTIC/GOM	85 (98%)	ALL- 35 (100%)
PACIFIC	63 (74%)	17 (94%)
ALASKA	30 (67%)	14 (88%)
TOTAL	178 (82%)	66 (96%)

The values reported in Table 15 represent stocks remaining at Tier 1 status, based on the level determinations detailed in NMFS (2004). According to NMFS (2004), stocks must be at Tier 2 status to fully comply with the mandates of the MMPA, yet within the 2013 SARs, only 18% of stocks overall and 4% of strategic stocks are at Tier 2. The region of most concern is Atlantic/GOM, where all but 2 stocks (both non-strategic), remain at Tier 1 status due to inadequate stock information.

DISCUSSION

The results for Goal 1 of this analysis indicate that significant data gaps remain in NMFS' marine mammal stock assessments. These data gaps exist in the SARs of all three regions (Atlantic/Gulf of Mexico, Pacific, and Alaska), although to a varying extent. One of the key data issues identified by GAO (2008) was NMFS' reliance on outdated stock abundance estimates that, given the potential for stocks to decline rapidly, may not reflect the current abundance of stocks. If an outdated abundance estimate drastically overstates a stock's current size and NMFS uses it to determine the stock's PBR, the PBR will in turn drastically overstate the number of animals that may be removed from the population without negatively affecting it. NMFS uses the ratio of PBR to annual human-caused mortality and serious injury as one mechanism for determining if a stock should be considered strategic. Therefore, an abundance estimate which, due to its age, does not accurately reflect true abundance, can lead NMFS to incorrectly determine stock status. NMFS faces the same scenario when a stock's abundance estimate is known to be either imprecise ($CV \geq 30\%$) or lacking an estimate of precision.

In its (2008) analysis of SARs, GAO estimated that of 74 sampled stocks, 11 stocks contained abundance estimates that were 8 or more years old, and 21 stocks contained abundance estimates that were between 5 and 8 years old. This analysis found that of 217 stocks, 22 stocks feature abundance estimates that are 8 or more years old, and 12 stocks feature abundance estimates that are between 5 and 8 years old. Because NMFS sampled only a portion of total stocks, these results are not directly comparable. However, in both cases it is evident that for more than a few marine mammal stocks NMFS' best estimate of abundance is greater than five years old, and therefore likely inaccurate.

For many other marine mammal stocks, NMFS has only imprecise estimates of abundance or abundance estimates with unknown precision. A total of 84 stocks in the 2013 SARs have imprecise abundance estimates, and another 26 stocks have abundance estimates with unknown precision. Of the three regions, Alaska has the highest percentage (22%) of stocks with abundance estimates that are 8 or more years old, and also the highest percentage of stocks with abundance estimates that have unknown precision. Alaska, however, has zero stocks with imprecise abundance estimates, while for the Atlantic/GOM and Pacific regions, almost 50% of all stocks contain imprecise abundance estimates (49% and 48%, respectively).

NMFS could improve the quality of stock abundance estimates by conducting more frequent marine mammal population surveys, but these are costly endeavors, especially in the remote region of Alaska. Recently, NMFS “has begun to develop passive acoustic methodologies to augment its traditional visual survey methods for marine mammals” (NMFS, 2004, p. 10). Although passive acoustic technology cannot currently be used on its own to measure abundance, it greatly enhances marine mammal detection rate. Ideally, “visual surveys and passive acoustics should be integrated in a synergistic way,” wherein, for example, deployed long-term acoustic recorders can provide information necessary for more targeted, precise visual abundance surveys (Van Parijs et al., 2007, p. 22). Passive acoustic monitoring could therefore be used to achieve less costly and more precise abundance estimates for targeted marine mammal stocks.

NMFS has also begun to supplement visual population surveys with Unmanned Aircraft Systems (UAS). These pilotless planes have the ability to capture “high quality video, infrared and still photographs” of marine mammals “in remote places that are costly, difficult, and dangerous to reach with traditional ships and planes” (NOAA, 2014, p.1). This technology can make possible additional and more frequent population surveys in distant regions such as Alaska, where a high percentage of stocks are in need of updated abundance estimates. Additionally, because UAS are quieter than traditional ships and planes, there is less potential for marine mammals to startle and scatter when in detection range (LLANOS, 2015). UASs have already been used successfully to conduct two Alaska marine mammal surveys, including one for the Western Steller sea lion stock in the Aleutian Islands, which had not been thoroughly surveyed since the 1970s. UAS has also been used to survey endangered monk seals in remote Hawaiian Islands (LLANOS, 2015). In 2015, NMFS plans to use UAS to survey populations of right whales in Massachusetts, gray whales in California, beaked whales in The Bahamas, orcas in British Columbia, and monk seals in Hawaii (NOAA, 2015). Moving forward, the use of UAS technology should enable NMFS to acquire additional stock abundance estimates, especially in remote regions.

More frequent and more precise population surveys, made possible by cost-effective versatile technologies such as passive acoustic monitoring and UAS, will likely enhance other stock data categories besides abundance. For instance, both technologies have the potential to

boost NMFS' knowledge of stock population trends (currently 81% of stock trends are unknown) and maximum reproductive rates (currently 91% of stock R_{Max} values are unknown), by providing more opportunities to observe stocks. Additionally, passive acoustic monitoring can be used to identify hotspots of animal presence, which can then be targeted for "biopsying or tagging studies," which provide vital information about stock structure (Van Parijs et al., 2007, p. 23). In its 2004 'requirements plan', NMFS concluded that stock identification was the data category most in need of improvement, with 61% of stocks being deficient (p. 24). This project determined that only 51% of stocks are currently deficient in stock structure information. However, of the key data categories that NMFS identified (Table 1), Stock ID remains the area of most concern, with more stocks deficient in this category versus all others. The use of technology to augment traditional survey methods should allow NMFS to expand its knowledge of stock identification and structure within all regions.

More comprehensive stock information will lead to more accurate estimates of PBR, which is calculated as the product of a stock's minimum abundance estimate, half of its R_{Max} , and a default recovery factor [MMPA Section 3 (20) ((A)(B)(C))]. Currently, 31% of stocks (including 44% of stocks in Alaska), have no calculated PBR because the available stock data is insufficient to calculate it. As PBR is a measure of how much annual human-caused mortality and serious injury a stock can sustain, without it NMFS does not have a means to assess the impact of fisheries. In such situations, NMFS cannot reliably determine if a stock should be considered strategic because it is unknown whether its annual human-caused mortality and serious injury exceeds its PBR. As one example, insufficient data on abundance of harp seals in the Western North Atlantic prohibits calculation of a PBR, yet the stock is subject to an estimated annual subsistence take of 306,082 animals (Waring et al, 2014, p. 352-253). Without being able to compare this level of take to a sustainable level of take (PBR), NMFS is ill-informed to determine stock status, yet the stock has been deemed non-strategic. For NMFS to make unambiguous status determinations, it must obtain estimates of PBR for all stocks; this can only be achieved through the collection of sufficient stock information.

To make the comparison of PBR to annual human-caused mortality and serious injury, NMFS must also have precise and comprehensive estimates of annual human-caused mortality and serious injury. Currently, 21% of stocks have unknown levels of human-caused mortality

and serious injury, while 16% of estimates are imprecise ($CV \geq 30\%$), and another 23% of estimates are of unknown precision. Cumulatively, this means that 129 out of 217 stocks, or 59% of total stocks in the 2013 SARs, have uncertain estimates of annual human-caused mortality and serious injury. Notably, estimates for this variable exist for all stocks within the Alaska region. However, in multiple cases these estimates are outdated. For example, the estimate of annual human-caused mortality and serious injury for ringed seals in Alaska (a strategic stock), 9,571 animals, is almost exclusively based on the estimated annual subsistence harvest of ringed seals (9,567) according to a database last updated in 2000. The database contained estimates from data gathered in villages in the 1980s through 1990s (Allen et al., 2014, p. 65). Unfortunately, “data on community subsistence harvests” of this and other stocks “are no longer routinely collected, and no new statewide annual harvest estimates exist” (Allen et al., 2014, p. 65). Moving forward, NMFS will have to determine whether the increasingly outdated estimates of subsistence-based annual human-caused mortality and serious injury are suitable for continued use within the SARs.

In the Atlantic/Gulf of Mexico and Pacific regions, fishery-related mortality is generally the largest contributor to overall annual human-caused mortality and serious injury. NMFS derives the majority of stocks’ estimated fishery-related mortality from reports of observers employed by NMFS’ National Observer Program (NMFS, 2013). An obvious means of increasing the accuracy of estimates is through expansion of the observer program to cover more fisheries. According to GAO (2008), “NMFS and Marine Mammal Commission officials identified inadequate observer coverage as one of the main reasons for imprecise mortality estimates” (p. 19). However, since 1998, NMFS has been gradually increasing both the number of sea days observed and the number of fisheries observed (NMFS, 2013a, Figure 1). In 2012, for example, “NMFS carried out observer programs in each Region, with 974 observers and over 83,000 sea days observed in 47 fisheries nationwide,” at a cost of “approximately \$69 million” (p. 10). Comparatively, in 2005, only 674 observers were employed for 67,030 observed sea days covering 42 fisheries, at a cost of \$44.7 million (NMFS, 2007). Despite the increasing trend, NMFS estimates that that an additional 66,653 observed sea days are required to provide adequate observer coverage of fisheries (NMFS, 2013a).

Additionally, in its most recent National Observer Program Annual Report (FY 2012), NMFS cautions that “given the nation’s fiscal problems, NOAA along with other federal agencies, will most likely be facing declining budgets in FY 2013 and beyond,” presenting a challenge of “how to balance increasing monitoring demands with decreasing federal funds” (p. 28). As with population surveys, NMFS has been experimenting with technological options to obtain more cost-effective observer coverage. Specifically, the agency has developed pilot projects to “test the feasibility” of “electronic monitoring (EM) using video cameras and electronic reporting (ER) using e-logbooks” (NMFS, 2013a, p. 27-28). Such methods could eventually replace expensive human observers in fisheries. They could even be made more efficient by the integration of facial recognition technology, which NMFS has been working with partners to develop for use in fisheries. “The basic idea is that digital video cameras would record all fish brought onboard and all fish or other animals discarded as bycatch. Then, the computers would identify the species passing in front of the camera” (NOAA, 2013). These technologies are not yet operational on a large-scale, but they offer promise for a future in which NMFS must strive to improve fishery-related mortality estimates despite the constraint of decreasing federal funding.

The results of the analysis for goal 1 indicate that significant data gaps remain within the stock assessment program. These data deficiencies are present in all categories that GAO identified in its 2008 analysis, and they are the reason why so many stocks remain at Tier 1 status, which is characterized by insufficient information in at least one of the categories listed in Table 1. Within the 2013 SARS, 82% of stocks are at Tier 1 status, including 96% of strategic stocks, which are those most at risk from bycatch. These percentages are alarmingly high given that NMFS considers Tier 1 status to be out of compliance with the MMPA (NMFS, 2004, p. vii). They are also not much different than those reported in NMFS’ report from 11 years ago; in 2004, 81% of stocks were at Tier 1 status (p. viii). Moving forward, NMFS will find it increasingly difficult to move stocks to Tier 2 status, given decreasing federal funding, unless it is able to make the stock assessment program more efficient.

Unfortunately, for the stocks which NMFS does have sufficient data to determine strategic status, the agency has not always complied with legislative mandates to establish TRTS when those stocks are interacting with a Category 1 or a Category 2 fishery. Based on

information within the 2013 SARS and the 2014 List of Fisheries, this project discovered 15 stocks meeting the requirements for a TRT that have not had TRTs established. GAO (2008) originally identified 9 of these stocks (marked by double asterisks in Table 13) as meeting the requirements for a TRT. As part of its investigation, GAO asked NMFS officials why the required TRTs had not been established. NMFS informed GAO that it had not established TRTs for 8 stocks (7 of which still meet TRT requirements⁴) because “the information the agency has on them is too outdated or incomplete for agency officials to determine whether these marine mammals should be considered a high priority for establishing a [TRT]” (GAO, 2008, p. 26). For example, the abundance estimate for the Gulf of Mexico bay, sound, and estuary common bottlenose dolphins was, in 2008, greater than 8 years old, and NMFS told GAO that “insufficient funding” prevented them from obtaining a new population estimate (GAO, 2008, p. 27). NMFS also blamed the lack of information about annual human-caused mortality and serious injury for this stock on inadequate funding.

Within the 2013 SARS, the Gulf of Mexico bay, sound, and estuary common bottlenose dolphins remain without an updated population estimate and without an estimate of annual human-caused mortality and serious injury. The other stocks first identified by GAO and again identified in this analysis also remain plagued with the same issues that NMFS identified in 2008 and said it was unable to correct due to funding constraints (GAO, 2008, p. 27). The purpose of a TRT team is to develop plans to reduce the fishery-related mortality of a stock, given that the current level of annual human-caused mortality and serious injury exceeds the stock’s PBR. Therefore, without a TRT, the strategic stocks interacting with Category 1 and Category 2 fisheries that cause either frequent or occasional mortality, will continue to remain imperiled because nothing is being done to reduce the unsustainable level of stock mortality.

Of the 14 stocks that GAO originally identified as needing a TRT (GAO, 2008, Table 3), a TRT has since been established for only one stock; this is the False Killer Whale Take Reduction Team, which was created in January of 2010. Unfortunately, as Table 14 describes, NMFS has missed 3 out of the 5 MMPA-established TRT deadlines. When a team misses deadlines, there is an associated delay in implementing the measures designed to reduce fishery-

⁴ These stocks are the three harbor porpoise Stocks in Alaska, two Steller sea lion stocks in Alaska, the Central North Pacific stock of humpback whales, and the common bottlenose dolphin Gulf of Mexico bay, sound, and estuary stock compilation (all listed in Table 13).

related mortality of the managed stock. The longer this delay, the more potential the stock has to decline below what the MMPA calls its “optimum sustainable population” [MMPA Section 2 (2)]. This problem of TRTs missing MMPA deadlines was also identified by GAO in its 2008 report. In response, GAO “acknowledge[d] [that] it may not be possible for NMFS to meet some of the MMPA’s deadlines given the requirements of other laws that NMFS must comply with...and the need for various levels of review and approval” (p. 44). Yet, GAO concluded, “unless the law is amended to address these situations, NMFS has a legal obligation to comply with [MMPA deadlines]” (p.44). The law has not been amended, and the legal obligation remains, but, as the False Killer Whale TRT demonstrates, the problem persists.

Although it appears that a majority of the issues identified by GAO (2008) continue to plague the stock assessment program, progress has been made on one matter. That is, GAO strongly urged NMFS to develop comprehensive monitoring strategies to assess TRP effectiveness (p. 9), and four out of seven TRTs have since complied. These teams now have multi-page documents outlining how they will evaluate the success of measures to reduce bycatch of the associated marine mammal stocks (NMFS, 2014). Hopefully, moving forward, NMFS will continue to implement GAO’s recommendations and develop cost-effective alternative technologies so that the marine mammal stock assessment program can achieve full compliance with the MMPA.

As it has been more than a decade since NMFS conducted an internal review of the program, and as we are now beyond the year (2010) in which NMFS predicted it would have sufficient resources, I recommend the agency perform an updated assessment of the resources being used to gather stock data and prepare stock assessments. In light of the predicted decrease in federal funding, the agency should focus on streamlining the program and ensuring that funds are targeted to the most urgent needs. I recommend that NMFS concentrate its data collection efforts on those stocks which have been identified as strategic but for which there is missing, imprecise, or outdated stock information (Tier 1 status). The status of these stocks, which comprise 96% of all strategic stocks, means that they are considered most at risk from bycatch, but they will remain imperiled unless sufficient data exists to support creation of a TRT. Alternatively, the acquisition of additional stock information may in some cases allow NMFS to redesignate strategic stocks as non-strategic, potentially freeing up resources. For all strategic

stocks known to be interacting with Category 1 and Category 2 fisheries, NMFS should make it a priority to establish TRTs. As fisheries continue to expand and intensify, there is a predicted likelihood of increased interactions between fishery gear and marine mammals. An effective marine mammal stock assessment program, which complies with MMPA mandates and which depends upon complete and accurate data, will be a vital tool in combatting marine mammal bycatch.

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