Monitoring Plan for Nine Distinct Population Segments of the Humpback Whale (*Megaptera novaeangliae*)

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Address questions about the monitoring plan to:

National Marine Fisheries Service, Office of Protected Resources, 1315 East-West Highway, Silver Spring, MD 20910

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Cover photo: Humpback whale breaching in the Bay of Fundy, Canada
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I. BACKGROUND AND INTRODUCTION

This document provides a plan for monitoring the nine Distinct Population Segments (DPSs) of the humpback whale (*Megaptera novaeangliae*) that were not listed as threatened or endangered under the Endangered Species Act (ESA) when the status of the humpback whale was revised (81 FR 62260, September 8, 2016).

A. Listing History

The humpback whale was listed as endangered in 1970 under the Endangered Species Conservation Act of 1969, the precursor to the ESA. When the ESA was enacted in 1973, the humpback whale was transferred to the List of Endangered and Threatened Wildlife, retaining endangered status, and, because of its endangered ESA status, was considered "depleted" under the Marine Mammal Protection Act (MMPA). NMFS issued a recovery plan for the humpback whale in 1991, and its long-term numerical goal was to increase humpback whale populations to at least 60 percent of the number of whales existing before commercial exploitation or 60 percent of current environmental carrying capacity. The recovery team that developed the recovery plan recognized that those levels could not then be determined, so it developed an interim goal to double the population size of extant populations within the next 20 years (*http://www.nmfs.noaa.gov/pr/pdfs/recovery/whale_humpback.pdf*). The historical size of humpback whale populations remains uncertain (Ruegg *et al*. 2013, and references therein; Bettridge *et al*. 2015).

Recent Revision to the ESA Listing

On August 12, 2009, NMFS announced the initiation of a status review of the humpback whale to determine whether an endangered listing for the entire species was still appropriate (74 FR 40568). NMFS sought information from the public to inform our review, contracted with two post-doctoral students to compile the best available scientific and commercial information on the species (Fleming and Jackson, 2011), and appointed a Biological Review Team (BRT) to analyze that information, make conclusions on extinction risk, and prepare a status review report (Bettridge et al., 2015).

Based on information presented in the status review report (which included a demographic analysis, threats analysis, and extinction risk analysis), NMFS' assessment of the BRT's conclusions, and efforts being made to protect the species, NMFS initially determined: (1) 14 populations of the humpback whale meet the NMFS and U.S. Fish and Wildlife Service joint 1996 DPS Policy criteria and are therefore considered to be DPSs: West Indies, Cape Verde Islands/Northwest Africa, Western North Pacific, Hawaii, Mexico, Central America, Brazil, Gabon/Southwest Africa, Southeast Africa/Madagascar, West Australia, East Australia, Oceania, Southeastern Pacific, and Arabian Sea); (2) two of the DPSs (Cape Verde Islands/Northwest Africa and Arabian Sea) are in danger of extinction throughout their ranges; (3) two of the DPSs (Western North Pacific and Central America) are likely to become endangered throughout all of their ranges in the foreseeable future; and (4) ten of the DPSs (West Indies, Hawaii, Mexico, Brazil, Gabon/Southwest Africa, Southeast Africa/Madagascar, West Australia, East Australia, Oceania, and Southeastern Pacific) are not in danger of extinction throughout all or a significant portion of their ranges or likely to become so in the foreseeable future). Accordingly, NMFS issued a proposed rule (80 FR 22303 April 21, 2015) to revise the species-wide listing of the humpback whale by replacing it with two endangered species listings and two threatened species

listings. NMFS also proposed to extend the ESA section 9 prohibitions to the two threatened DPSs.

NMFS opened a 90-day public comment period on the proposed rule seeking input and any new information to ensure the final determination was based on the best available scientific and commercial information. NMFS also held four public hearings to receive feedback. NMFS published a final rule on September 8, 2016 (81 FR 62260). Most of the determinations remained the same as proposed, but three changed: we listed the Central America DPS as endangered instead of threatened, the Western North Pacific DPS as endangered instead of threatened; and the Mexico DPS as threatened instead of "not warranted." The nine DPSs that are not listed as threatened or endangered and that are the subject of this Monitoring Plan are further described in section IV.C. below.

B. Humpback Whale Protection and Monitoring under the MMPA and other Laws

Humpback whales are protected under the MMPA and other laws and regulations, including local, state, national, and international protections from threats such as fishing gear entanglement, ship strike, whale watching, and direct harvest. Humpback whales are also monitored under the authority of various laws and agreements, such as the required development of Stock Assessment Reports (SARs) for humpback whales in U.S. waters, and comprehensive assessment of Southern Hemisphere humpback whales coordinated by the International Whaling Commission (IWC). More detailed information on humpback whale protection and monitoring is included in Appendix A.

C. Monitoring Requirements under the ESA

Section 4(g)(1) of the ESA requires that NMFS:

> "...implement a system in cooperation with the States to monitor effectively for not less than five years the status of all species which have recovered to the point at which the measures provided pursuant to this Act [the ESA] are no longer necessary...."

General guidance for monitoring plan development is provided by recommendations jointly developed by the U.S. Fish and Wildlife Service and NMFS (USFWS and NMFS 2008). This Post-Delisting Monitoring Plan (PDMP) guidance clarified that:

> "The primary goal of PDM is to monitor the species to ensure the status does not deteriorate, and if a substantial decline in the species…or an increase in threats is detected, to take measures to halt the decline so that re-proposing it as a threatened or endangered species is not needed."

The PDMP guidance also indicated that:

> "Each PDM plan should provide a species-specific discussion of the circumstances that would trigger termination of PDM, intensification of PDM, initiation of a new status review, or emergency listing... Such decisions often require consideration and interpretation of multiple factors, including changes in threats and/or demographic trends. Therefore, this section of the PDM plan may not be limited to quantitative criteria, but also includes qualitative considerations (such as indicators of changing threats) and

> guidance on how demographic data should be interpreted (for example, to separate a decline in productivity due to a recurring or new threat versus a decline due to expected effects of density-dependence). The narrative may also include guidance on how multifaceted PDM results might be integrated to support biologically sound decision making. In most cases, specification of these triggers or thresholds will be based on information and decision-making processes documented during the recovery planning and delisting processes.
>
> "For species subject to natural cyclic trends or substantial environmental variation, the expected range and frequency of variation should have been well-documented during the recovery period and appropriately considered in the PDM plan. If a species may approach carrying capacity in some or all parts of its range during the PDM period, then biologists must anticipate the possibility that density-dependent factors may trigger declines in productivity and/or survival and provide measures to distinguish these from signals that the species is exhibiting a bonafide decline in its probability of persistence."

Information and recommendations specific to the humpback whale are also provided in the Humpback Whale Recovery Plan (NMFS 1991). Further, in 2005, a North American Conservation Action Plan (NACAP) was developed for humpback whales under the 1994 mandate of the North American Agreement for Environmental Cooperation. Through the Commission for Environmental Cooperation, researchers and species managers in Mexico, Canada, and the U.S. jointly developed the NACAP, which identifies threats monitoring and prevention (including ship strikes, entanglement, acoustic, and ecotourism impacts) as a priority.

Although NMFS' determination that certain DPSs of humpback whale no longer qualify for listing is not technically a "delisting," for the reasons explained in the ESA listing final rule, we find that it is appropriate to monitor the status of the populations that are no longer listed. This is consistent with the intent of Section 4(g)(1) of the ESA. 16 U.S.C. 1533(g)(1). The PDMP guidance thus guides us in our development of a monitoring plan for those humpback whale DPSs.

NMFS developed this humpback whale monitoring plan in cooperation with representatives from the Alaska Department of Fish and Game, Hawaii Department of Land and Natural Resources, Massachusetts Division of Marine Fisheries, Hawaiian Islands Humpback Whale National Marine Sanctuary, and Glacier Bay National Park and Reserve. NMFS solicited and received public comment and peer review on the draft plan during a 30-day comment period (81 FR 14820; March 18, 2016). The Federal Register notice and other documents related to revising the humpback whale listing are posted on the NMFS web page: (*http://www.fisheries.noaa.gov/pr/species/mammals/whales/humpback-whale.html*).

NMFS is responsible for the successful implementation of this monitoring plan and for ensuring its adequacy under the ESA. NMFS, in cooperation with States, other federal agencies, foreign governments, non-governmental organizations, Indian tribal governments, Alaska Native tribal governments or organizations, and other partners, will monitor the humpback whale DPSs that are not listed as endangered or threatened for 10 years following the final determination to revise the listing status of the humpback whale (81 FR 62260, September 8, 2016) by maintaining

existing monitoring programs and expanding the effort where needed and as possible to address concerns specific to this PDMP.

II. OBJECTIVES

In keeping with the broad goals discussed in the PDMP guidance (USFWS and NMFS 2008), the Humpback Whale Recovery Plan (NMFS 1991), and issues raised in the Status Review (Bettridge *et al.* 2015), this Monitoring Plan has three primary goals:

1. Monitor each DPS to detect changes in trends in production of calves and adult/juvenile abundance and population growth rates, and distinguish if changes are a threat to the DPS or a signal that the DPS is approaching or has surpassed the DPS' carrying capacity;
2. Monitor the DPSs to detect changes in spatial and temporal distribution; and
3. Monitor residual or emerging threats, and identify new threats that could affect the sustainability of the recovery of the humpback whale DPSs.

The monitoring of population status and threats must be sufficient to allow NMFS to detect any problems or issues related to the three goals listed above, and, if necessary, to take action so that listing the DPSs as threatened or endangered is not needed (USFWS and NMFS 2008). Such action could be in the form of intensified PDM. The monitoring must also provide NMFS with the information needed to determine when it is appropriate to initiate a new status review or list a DPS on an emergency basis. On the other hand, the monitoring must also provide NMFS with enough information to determine that a DPS is healthy or has reached carrying capacity, and therefore, that it may be appropriate to terminate PDM.

Population abundance and growth rate estimates differ in quality for different humpback whale DPSs. Acquiring these types of new data depends on whale surveys, which are infrequent. Data collection and analysis efforts to support Take Reduction Teams and monitor Take Reduction Plans, entanglement response efforts, and stranding networks provide important data for monitoring threats. NMFS will promote efforts to acquire these data on the breeding and feeding grounds and examine trends and threats for each of the DPSs as data become available to support evaluation of the goals listed above. More specifically for goal #3, analyses should investigate the extent to which threats such as fishing gear entanglement, vessel strikes, disease, parasites, contaminants, biotoxins, direct take (e.g. whaling, subsistence harvest), declines in abundance of important prey, habitat degradation, whale watching, underwater noise, disturbance, tourism, predation, research, and climate change and ocean acidification are affecting different humpback whale DPSs. In addition to the data collected through these avenues, NMFS will examine monitoring data provided by various cooperating humpback whale research entities following each seasonal monitoring effort. If necessary, NMFS will propose adjustments to the sampling design to ensure comparability of the data over area and time. NMFS may request information from Canada and other countries within the range of these humpback whale DPSs to obtain information on humpback whales off the coasts of other countries.

Section 4 of the ESA requires monitoring for not less than five years following removal of species from the List of Endangered and Threatened Wildlife due to recovery, but NMFS recommends that monitoring occur for 10 years to ensure that humpback whale DPSs that are not listed under the ESA remain in a recovered state. This recommended period is necessary in part

because of the biology of this long-lived, late maturing species and the difficulty in obtaining data on a regular basis to detect changes in population abundance and trends.

If these data or other substantial information indicate that any non-listed humpback whale DPS is experiencing decreases in calf production, juvenile and adult abundance, population growth rate, or distribution that may be cause for concern, or that any existing or emerging threat seems to be negatively affecting production, abundance, population growth rate, or distribution, NMFS will convene an ad hoc team of experts (membership to be determined at the time) to decide whether monitoring should be extended or more intensive review or studies should be initiated to determine the cause or provide more details on the mechanisms, and to determine whether to initiate a status review or recommend to the Secretary that the DPS be listed on an emergency basis. Similarly, if these data or other substantial information indicate that the DPS seems to be exhibiting growth rates and other population parameters indicative of a healthy population or one that is approaching carrying capacity, NMFS will convene a team of experts to determine if ending monitoring early (before 10 years) is appropriate, though PDM will continue for at least 5 years. Because information on calf production, abundance, growth rate, and distribution of different DPSs may not be easy to obtain on a regular basis, it is expected that this monitoring plan will rely heavily on threat monitoring (e.g., entanglement and ship strike data, MMPA take permits, unusual mortality events, federal actions occurring in humpback whale habitat, effects of ocean acidification).

III. IMPLEMENTATION

NMFS has the lead for planning, coordinating, and implementing this monitoring effort. A Monitoring Plan Working Group was established to develop the monitoring plan, and will be involved in evaluating the monitoring program and its results on an ongoing basis. The Working Group includes the Humpback Whale Monitoring Plan Coordinator, NMFS regional coordinators (staff from the Alaska, Pacific Islands, West Coast, and Greater Atlantic regional offices), and other collaborators from the NMFS Alaska Fisheries Science Center (AFSC), Alaska Department of Fish and Game, Hawaii Department of Land and Natural Resources, Massachusetts Division of Marine Fisheries, Glacier Bay National Park and Preserve, and Hawaiian Islands Humpback Whale National Marine Sanctuary (Appendix B). The NMFS National ESA Listing Coordinator led the planning for and development of the Monitoring Plan, but is not expected to be involved in the implementation and evaluation of the Monitoring.

Additionally, as envisioned in the Services' Post-Delisting Monitoring Plan Guidance (USFWS and NMFS 2008), additional individuals and entities will be instrumental in implementing the Monitoring Plan by providing data, expertise, or other resources. Appendix C lists those who have explicitly agreed to collaborate with NMFS in this effort.

The role of the Humpback Whale Monitoring Plan Coordinator is to:

- Distribute the monitoring plan to relevant NMFS staff and collaborators (including members of the Monitoring Plan Working Group and collaborators identified in Appendix C);
- Provide guidance on ESA and MMPA provisions relevant to humpback whales and this monitoring plan to other relevant NMFS staff;
- Seek partnerships with other agencies to implement the plan;

- Organize meetings with collaborators as necessary to evaluate and plan monitoring efforts;
- Coordinate with the NMFS Office of Protected Resources' Permits and Conservation Division regarding permits issued under the MMPA to ensure that monitoring requirements are consistent and that data acquired from related monitoring are provided;
- Coordinate with NMFS regional staff, appropriate states, and others to obtain monitoring data from each region;
- Consult and coordinate with the IWC to obtain monitoring data for Southern Hemisphere humpback whales;
- Organize and submit regional budget requests within NMFS, when funding is available;
- Provide informal annual reports to the Monitoring Plan Working Group (e.g., via email or conference call) summarizing available monitoring results and implementation of the monitoring plan, including highlighting any significant hurdles to implementation and/or changes in monitoring objectives, methods, or intensity;
- Prepare interim and final reports (see section VI. REPORTS below);
- Publish a Notice of Availability for the interim and final reports in the Federal Register and on appropriate web sites;
- Post interim and final reports on the NMFS Office of Protected Resources web site;
- If a "Response Trigger" has been met (see section V. DATA EVALUATION below), in consultation with the States and the Monitoring Plan Working Group, convene and coordinate the meetings or other activities of ad hoc groups of experts; and
- Convene the Monitoring Plan Working Group to update the monitoring plan as needed, based on results of informal annual reports or formal interim reports.

The role of NMFS Regional Coordinators is to:

- Establish and/or maintain a network of collaborators (external researchers, organizations, and other entities, some of whom are identified in Appendix C) who monitor humpback whales and threats to their recovery within their Region;
- Seek or continue partnerships with relevant states, tribes, other governmental agencies and nongovernmental organizations to implement the plan;
- Determine budget requirements to carry out monitoring in their Region and help secure potential funding, as possible;
- Submit regional funding needs to the Humpback Whale Monitoring Plan Coordinator, and assist in distributing funds to the collaborators;
- Work with other NMFS Regional Office and Science Center staff to plan, implement, and/or analyze surveys (when funds are available), and summarize monitoring results in cooperation with States and other collaborators;
- Participate in established regional working group meetings, or establish a regional working group, as necessary, to assist in the planning and implementation of the monitoring surveys;
- Coordinate with tribes on monitoring activities on or near tribal lands;
- Ensure that monitoring data are collected using methods that meet the requirements of this monitoring plan, when feasible;
- Coordinate the collection and compilation of regional monitoring data and results;

- Provide monitoring results to the Humpback Whale Monitoring Plan Coordinator for inclusion in the informal annual reports and formal interim and final reports; and
- Participate in Monitoring Plan Working Group calls and meetings, and make recommendations to the Humpback Whale Monitoring Plan Coordinator and the Monitoring Plan Working Group based on survey and other monitoring results.

Population abundance and growth rate estimates are made when and if new data from surveys become available from anywhere throughout the range of the humpback whale. Similarly, assessment of threats is dependent on monitoring throughout the humpback whale's range. Consequently, the role of the Regional Coordinators will be largely to ensure that the Monitoring Plan is executed within their regions, as needed. Regional Coordinators are expected to work with collaborators involved in these efforts.

Monitoring Plan Working Group members (Appendix B) and collaborators in other agencies and entities (including those in Appendix C and others) will, as resources are available, undertake key components of monitoring and will create and maintain a strong and adequate monitoring program.

IV. MONITORING METHODS

During the 10-year post-delisting monitoring period, NMFS will work with collaborators throughout the range of the humpback whale, to the extent possible, to:

- Monitor abundance trends of each humpback whale DPS
- Update estimates of population growth rates for each humpback whale DPS, as data become available
- Monitor spatial and temporal distribution of humpback whales in each DPS
- Monitor and assess potential threats to continued recovery for each humpback whale DPS, including:
    - ⇒ Entanglement in fishing gear
    - ⇒ Vessel strikes
    - ⇒ Disease, parasites, contaminants, biotoxins
    - ⇒ Direct takes (whaling, subsistence harvest)
    - ⇒ Declines in abundance of important prey
    - ⇒ Degradation of marine habitats
    - ⇒ Whale watch activities
    - ⇒ Underwater noise
    - ⇒ Disturbance
    - ⇒ Tourism
    - ⇒ Predation
    - ⇒ Research
    - ⇒ Climate change/ocean acidification

Under Section 117 of the MMPA, NMFS is required to update U.S. Marine Mammal Stock Assessment Reports (SARs) every three years or when new information becomes available for non-strategic stocks, and annually for strategic stocks. If the review shows that the status of the stock has changed or can be assessed more accurately, NMFS revises the SAR in consultation

with the relevant Scientific Review Group and after public review and comment. NMFS may reconsider the boundaries of the MMPA humpback whale stocks to determine whether it is prudent to align them with the DPS boundaries of humpback whales that occur in U.S. waters. Regardless of the overlap between MMPA stocks and ESA DPSs, the SARs will continue to provide information regarding: a description of the stock's geographic range, a "minimum population estimate," current population trends, current and maximum net productivity rates, "Potential Biological Removal" (PBR) levels, status of the stock, and estimates of annual human-caused mortality and serious injury by source.

At least some whales from each of the nine non-listed DPSs occur in waters outside the jurisdiction of the United States. Therefore, NMFS will coordinate with the IWC, foreign nations, and other entities in an effort to obtain data to monitor their status.

A. Abundance Trends

Data will be collected from ongoing whale shipboard and aerial surveys over the next 10 years to make abundance estimates, using photo ID mark-recapture data, for each DPS. The most appropriate abundance estimation method (mark-recapture, minimum population, line transect) will be used, depending on whether model assumptions are met. Other methods may be used if further research and modeling indicate better ways to avoid various biases.

B. Population Growth Rates

While also recognizing resource limitations and constraints, data will be collected from ongoing whale shipboard and aerial surveys (and opportunistically, through whale watching trips, and threat monitoring efforts) over the next 10 years to estimate population growth rate, using photo ID mark-recapture data, for each DPS. The interbirth-interval method (Barlow and Clapham 1997) may be used to estimate reproductive rates, and the modified Jolly-Seber approach (Buckland 1980) may be used to estimate non-calf survival rates, and the resulting estimates of demographic parameters (reproductive rates and non-calf survival rates) may then be used to estimate population growth rate (λ), with standard error calculated using a Monte Carlo approach (Barlow and Clapham 1997). Other methods may be used if further research and modeling indicate better ways to avoid various biases. For example, analytical research may improve our ability to model observed variability in survival rates and birth rates (Clapham *et al*. 2003).

C. Spatial and Temporal Distribution

Data will be collected from ongoing whale shipboard and aerial surveys (and opportunistically, through whale watching trips, and threat monitoring efforts) over the next 10 years to monitor spatial and temporal distribution of each DPS. For example, for the West Indies DPS, a systematic photo-ID survey of the entire Scotian shelf could help clarify the status and habitat use of humpback whales in this largely unstudied region of the North Atlantic and the relation between this feeding ground and the Gulf of Maine (Clapham *et al*. 2003). A large contraction in range would indicate a red flag.

Recent abundance and population growth estimates, current distribution, and ongoing work

Below are the most recent estimates of abundance (n) and population growth rate (λ), and a description of current distribution (Bettridge *et al*. 2015) for each DPS. Information for some DPSs has been updated since the Status Review, as described in the final rule and included

below. Also included is a summary of ongoing surveys that can be used to estimate abundance and population growth rates and monitor any changes in spatial and temporal distribution for each DPS.

West Indies DPS (*n*~10,500, λ=3.1%):

The breeding range of the West Indies DPS includes the Atlantic margin of the Antilles from Cuba to northern Venezuela, and its feeding range primarily includes the Gulf of Maine, eastern Canada, and western Greenland. While many West Indies whales also use feeding grounds in the central (Iceland) and eastern (Norway) North Atlantic, many whales from these feeding areas appear to winter in another location.

Extensive work is being done in the Gulf of Maine, and surveys off West Greenland will possibly continue. There is occasional sporadic work elsewhere, but no relevant research in the West Indies.

Hawaii DPS (*n*~11,400, λ=5.5-6%):

The Hawaii DPS consists of humpback whales that breed within the main Hawaiian Islands. Whales from this breeding population have been observed in most known feeding grounds in the North Pacific, but about half of the whales from this population migrate to Southeast Alaska and Northern British Columbia. They also commonly use northern Gulf of Alaska and Bering Sea feeding grounds.

There is ongoing mark-recapture work in Hawaii and Southeast Alaska, but expansion of spatial coverage would likely be required to provide sufficiently robust data to reliably estimate abundance and trend. A 30-year time series (beginning in 1985) of life history and abundance trend information is available for waters in and near Glacier Bay National Park in southeastern Alaska. The National Park Service intends to continue this work indefinitely, thus this population could be considered a geographically limited but valuable index that informs NMFS of the changing life history traits (calving rate, age at maturity, population trend) of the Hawaii DPS.

Brazil DPS (*n*~6,400, λ=7.4%):

This DPS consists of whales that breed between 3°S and 23°S in the southwestern Atlantic along the coast of Brazil with a prominent concentration around the Abrolhos Bank (15°-18°S), and feed off South Georgia and the South Sandwich Islands.

Ship surveys were conducted in 2008 and 2012 for abundance, and aerial surveys have been ongoing since the mid 2000s. There will likely be good data to monitor trends for this DPS, which corresponds with IWC Breeding Stock A - Western Atlantic Ocean.

Gabon/Southwest Africa DPS (*n*~7,100, λ=increasing at an unknown rate):

This DPS consists of whales that breed and calve off central western Africa between ~6°S and ~6°N in the eastern Atlantic, including the coastal regions of northern Angola, Congo, Togo, Gabon, Benin, other coastal countries within the Gulf of Guinea and possibly further north. This DPS is thought to feed offshore of west South Africa and Namibia south of 18°S and in the Southern Ocean beneath west South Africa (20°W – 10°E).

There is ongoing photo-identification work in IWC Breeding Stock B (Eastern Atlantic: B1 - Gabon; B2 - West South Africa); the data may be useful for future estimates of trends, but their robustness is not clear.

Southeast Africa/Madagascar DPS (*n*~7,000-7,400, λ=increasing at an unknown rate)

The Southeast Africa/ Madagascar DPS includes whales breeding in at least three different areas in the western Indian Ocean: one associated with mainland coastal waters of southeastern Africa, extending from Mozambique to as far north as Tanzania and southern Kenya; a second found in the coastal waters of the northern Mozambique Channel Islands and the southern Seychelles; and the third found in the coastal waters of eastern Madagascar. The feeding grounds of this DPS in the Southern Ocean are not well defined but are believed to include multiple localities to the west and east of the region bounded by 5°W – 60°E.

Some work is ongoing in IWC Breeding Stock C (Western Indian Ocean: C1 - Mozambique; C3 - Madagascar), but at present, there are not enough details to assess whether this would provide sufficiently robust data for estimation of trend.

West Australia DPS (*n*~21,800, λ=10%)

The West Australia DPS consists of the whales whose breeding/wintering range includes the West Australia coast, primarily in the Kimberly Region. Individuals in this population migrate to feeding areas in the Antarctic, primarily between 80°E and 110°E based on tagging data.

There is ongoing survey work in IWC Breeding Stock D (Eastern Indian Ocean) aimed at abundance and trend, which is likely to provide robust data for these analyses.

East Australia DPS (*n*~6,300-7,800, λ=10.9%)

The East Australia DPS consists of the whales' breeding/wintering along the eastern and northeastern Australian coast. Based upon tagging, telemetry, and re-sighting data, individuals in this population migrate to Antarctic feeding areas ranging from 100°E to 180°E, but concentrated mostly between 120°E and 180°E.

There is ongoing survey work in IWC Breeding Stock E1 (Western South Pacific) aimed at abundance and trend, which is likely to provide robust data for these analyses.

Oceania DPS (*n*~3,800, λ=3%)

The Oceania DPS consists of whales that breed/winter in the South Pacific Islands between ~160°E (west of New Caledonia) to ~120°W (east of French Polynesia), including American Samoa, the Cook Islands, Fiji, French Polynesia, Republic of Kiribati, Nauru, New Caledonia, Norfolk Island, New Zealand, Niue, the Independent State of Samoa, Solomon Islands, Tokelau, Kingdom of Tonga, Tuvalu, Vanuatu, Wallis and Futuna. Individuals in this population are believed to migrate to a largely undescribed Antarctic feeding area.

There is ongoing mark-recapture work in IWC Breeding Stocks E2, E3, and F (Central South Pacific), coordinated by the South Pacific Whale Research Consortium in selected locations (New Caledonia, Cook Islands, French Polynesia, occasionally Tonga and elsewhere) aimed at estimating abundance and trend.

Southeastern Pacific DPS (*n*~6,500, λ=increasing at an unknown rate)

The Southeastern Pacific DPS consists of whales that breed/winter along the Pacific coasts of Panama to northern Peru (9°N-6°S), with the main wintering areas concentrated in Colombia. Feeding grounds for this DPS are thought to be concentrated in the Chilean Magellan Straits and the western Antarctic Peninsula. These cross-equatorial breeders feed in the Southern Ocean during much of the austral summer.

Photo-identification work is in progress in IWC Breeding Stock G (Eastern South Pacific), but for this stock, effort is typically very localized.

D. Threats

In the Humpback Whale Status Review (Bettridge *et al*. 2015), the Biological Review Team reviewed each of the ESA section 4(a)(1) factors (threats) and concluded that there are no current or known threats that contribute significantly to the extinction risk of these DPSs of humpback whale. NMFS agreed with the BRT's conclusions and determined that none of these threats are causing these DPSs to be in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of their ranges. The ESA section 4(a)(1) factors are:

A. Present or threatened destruction, modification, or curtailment of its habitat or range;
B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. Inadequacy of existing regulatory mechanisms; and
E. Other natural or manmade factors affecting its continued existence.

During the 10-year monitoring period, NMFS will continue to collect information about potential and residual threats to aid in the understanding of population response in the event that either the abundance or trend of any of these humpback whale DPSs changes. In the context of post-delisting monitoring, USFWS and NMFS (2008:2-2) defined residual threats as "…threats that, collectively, are sufficiently reduced and contained that the species no longer meets the definition of threatened or endangered." These threats can, however, still have adverse effects on humpback whales.

NMFS will:

Annually

- Monitor for and summarize data on unusual mortality events, other strandings, and entanglements via marine mammal stranding networks and research activities, including events caused by fishing gear, vessel strikes, disease outbreaks, etc. This will be done by NMFS in conjunction with our partners in the States, foreign countries, other federal agencies, and through cooperation, consultation and communication with the various coastal tribes and Alaska Native organizations, The Marine Mammal Center (TMMC), Sausalito, California, and other members of the stranding network. Marine Mammal Stranding Networks within the range of the West Indies, Hawaii, and Oceania DPSs are coordinated through the NMFS Greater Atlantic, Alaska, and Pacific Islands Regional Offices. Data on entanglement in fishing gear (e.g., net fragments, trolling gear, longline gear) will be collected by NMFS, NOAA's National Ocean Service, Alaska Department

of Fish and Game, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Tribes, and others during surveys and opportunistically. Samples will be collected from carcasses for testing for disease agents, contaminants, health, age, and diet, as resources and the condition of the carcass permit. As possible, necropsies will be performed on humpback whales that are found dead to determine, if feasible, a cause of death. This monitoring directly addresses ESA section 4(a)(1) factors A, B, C, and E.

- Monitor for and summarize data on vessel strikes and entanglements from fisheries and aquaculture operations. NMFS will undertake monitoring through fishery observer programs and through the Marine Mammal Authorization Program (MMAP) (which requires fishermen to self-report marine mammal injuries and deaths) for commercial fisheries without observer programs. Monitoring will also be accomplished in conjunction with our partners in the States and Canada's Department of Fisheries and Oceans (DFO) through fishery observer and other programs. Tribal fisheries operate on the northern Washington coast and Strait of Juan de Fuca under treaty rights, and are exempt from observer programs. The Makah Indian Tribe is committed to monitoring tribal fisheries, and support for National Marine Mammal Laboratory and tribal partnerships to monitor these fisheries should continue. This monitoring directly addresses section 4(a)(1) factors B, D, and E.

Triennially (every three years, beginning in 2018)

- Monitor for disease, contaminants, and health. At least every 3 years during the 10-year monitoring period, beginning in 2018, NMFS, in collaboration with partners in the States, other countries, universities and other research and animal response entities (e.g., the North Pacific Marine Mammal Consortium, Southern Hemisphere Consortium, The Hawaii Marine Mammal Center, National Institute of Standards and Technology, etc.), other agencies, and various tribes and Alaska Native organizations, will tabulate documented incidences of disease, contaminants and ill health in the humpback whale DPSs. Body condition should be assessed during health assessments at all age classes.

- Monitor the abundance, distribution and protection of important prey species, as possible, including prey removal levels in humpback whale feeding areas. As the humpback whale DPSs continue to increase in abundance, they may reach and/or possibly exceed carrying capacity in certain locations and nutritional stress could affect population dynamics. Alternatively, nutritional stress could develop due to competition with fisheries, effects of climate change, etc. Data are lacking for most locations for humpback whale prey species that are not commercially harvested. However, as some humpback whale prey species are harvested in commercial and recreational fisheries, the abundance and overall health of the related fish stocks are already monitored by NMFS, state, DFO, or tribal entities, and allowable and actual harvest levels are also, in some cases, set and/or monitored by these entities. At least every 3 years during the 10-year monitoring period, beginning in 2018, NMFS will review and summarize available reports on the abundance, health, and harvest levels of the primary humpback whale prey species throughout the range of each DPS. This directly addresses section 4(a)(1) factor A.

- Monitor human activities near breeding and feeding areas. At least every 3 years during the 10-year monitoring period, NMFS will query partners, and review available documents, to determine the current and projected levels of human activities (e.g., noise, oil exploration, vessel traffic, pollution, whalewatching) near breeding and feeding areas. This directly addresses section 4(a)(1) factor A.

- Monitor impacts of research activities. At least every 3 years during the 10-year monitoring period, beginning in 2018, NMFS, in conjunction with our collaborators in other countries, the States, the tribes, and other research entities, will review and synthesize information from permit reports submitted by humpback whale research permittees to evaluate the overall levels of death, injury, and behavioral harassment that result from all research on humpback whale DPSs. NMFS will evaluate whether there are steps that need to be taken to reduce the overall level of research take. This directly addresses section 4(a)(1) factors B and D.

- Monitor subsistence harvest. At least every 3 years during the 10-year monitoring period, beginning in 2018, NMFS will request and tabulate data from other nations on subsistence harvest in Greenland and St. Vincent and the Grenadines. This monitoring directly addresses section 4(a)(1) factors B, D, and E.

Other

- Contingent on funding availability, NMFS will conduct sampling for key contaminants (especially those with known potential to affect reproduction, immune system function, or survival), disease agents, and health indices, at or near the time of the final ESA listing determination in 2016 (to establish a baseline), again in 2021, and at the end of the 10-year monitoring period in 2026. The priorities for this sampling in each state will be developed by the NMFS Regional Coordinators, in consultation with collaborators on the Monitoring Plan Working Group and the regional collaborators. However, at a minimum, a standard disease panel should be run as well as testing for emerging diseases. The stranding network, the Marine Mammal Center, and NMFS (NWFSC, other science centers) will provide information on any possible influence of harmful algal bloom toxins, novel diseases, and other noteworthy findings from stranded humpback whales in their area. Ideally, samples from stranded animals and subsistence harvested animals will be used in this monitoring effort. This directly addresses section 4(a)(1) factors C and E.

- Monitor the emerging potential threat of climate warming and ocean acidification--NMFS recognizes that climate warming and ocean acidification potentially pose long-term threats to humpback whales, but acknowledges that at the time of our revision of the listing status, the likely impacts are uncertain both with respect to magnitude and kind. As part of monitoring, NMFS will, in collaboration with collaborators and other interested entities, review midway through this monitoring period (2021) the data gathered through stranding networks from live and dead whales to assess trends in body condition and health assessment. In addition, recent literature and other information will be reviewed on the known impacts of climate warming and ocean acidification on humpback whale prey species and associated marine ecosystems throughout the range of these DPSs to determine whether the best available information indicates directed studies

or monitoring are needed and to determine whether information indicates that the threat from these factors is fundamentally different in kind or magnitude than known at the time of our final determination. This directly addresses section 4(a)(1) factors A and E.

V. DATA EVALUATION

A. Review of Monitoring Data Relative to "Response Triggers"

NMFS Regional Coordinators will work with the States and other collaborators as appropriate to annually compile the available monitoring results for their respective monitoring region and provide them to the Monitoring Plan Coordinator for inclusion in informal annual reports to the Monitoring Plan Working Group. These individuals will also evaluate available monitoring results and prepare a written assessment for submission to the Monitoring Plan Coordinator and inclusion in the formal interim and final reports (see section VI. REPORTS below). The assessments will include a summary of the monitoring data, state whether any of the "response triggers" shown below have been reached, determine whether the data collection protocols are functioning as anticipated or whether any changes are needed, and include an initial determination of any threats that may warrant further evaluation.

In response to any issues that are cause for concern (i.e., at least one trigger from the list in the "Negative TriggersNegative Triggers" section below has been met), NMFS in cooperation with appropriate States will convene a team of experts (membership to be determined at the time) to evaluate the information and recommend:

- Increase the sensitivity of the status and trend monitoring protocol to detect DPS-wide or regional declines in any of the parameters by, for example, increasing survey frequency;
- Design research that would determine causes of changes in population trend, or declines in calf production or vital rates;
- Work with States, tribes, or other entities to exercise their regulatory authorities to alleviate known or suspected threats;
- Use existing regulatory authorities under the MMPA to protect the species and/or its habitat;
- Extend the monitoring period;
- Conduct regional or DPS-wide status assessment(s) to evaluate the significance of threats to humpback whale DPSs;
- Evaluate whether to initiate a new status review under the ESA to determine if any of the humpback whale DPSs are threatened or endangered under the ESA; or
- Recommend emergency listing of any of the humpback whale DPSs.

In response to evidence that a DPS is approaching environmental carrying capacity (i.e., at least one trigger from the list in the "Positive Triggers" section below has been met), NMFS in cooperation with appropriate States will convene a team of experts (membership to be determined at the time) to determine if it is appropriate to terminate PDM for that DPS. Early termination of monitoring is possible between 5 and 10 years.

B. Response Triggers

The "response triggers" listed below will, in addition to other factors described above, prompt additional evaluation and appropriate response by the Monitoring Plan Working Group. The Monitoring Plan Working Group will evaluate these triggers within each monitoring region and

for all regions combined at the end of the 10-year monitoring period and at more frequent intervals as data become available (e.g., in conjunction with interim reports) in an effort to determine the status of each DPS.

Abundance trends, population growth rates, spatial and temporal distribution, and threats monitoring will be assessed in an integrated manner to discern the underlying reason for the observed data trends. For example, declining abundance and growth rate could be a cause for concern. However, a stable abundance and declining population growth rate could indicate that the DPS is at or is approaching carrying capacity, or has increased in population size beyond carrying capacity and has a declining population growth rate due to density-dependent factors. Temporary declines in calf production, juvenile survival, or both, in one season or more than one season, can occur in response to environmental conditions (e.g., El Niño-Southern Oscillation events), but may not be indicative of the population's long-term trend. There could be a natural reduction in productivity, a decline in population growth rate, or increasing intra-specific competition as a population approaches carrying capacity (Clapham *et al.* 2003). Also, if there is top down forcing (e.g., predation, ship strikes), we may see an increase in per capita calf production while the overall population declines. Evidence of a decline in body condition of stranded whales, with malnourished animals indicating potential for food limitation, could be indicative of approaching, reaching, or exceeding carrying capacity. Or, it could indicate a reduction in prey availability or a response to pollutants or toxins. Should declines be noted, available information on natural causes and anthropogenic factors will be evaluated.

After a trigger is reached and the team of experts recommends that a new status review is appropriate, NMFS would make any relisting decision by evaluating the status of the each humpback whale DPS relative to the ESA's five section 4(a)(1) factors.

Response triggers

<u>Negative Triggers</u>

- Any significant decline in abundance or range;
- A decline in birth or survival rates of humpback whale individuals (beyond what would be expected as populations approach their natural carrying capacity) based on marked animal studies in the areas where these surveys occur, or new estimates of birth rate which indicate that individuals from any humpback whale DPSs are negatively responding to a new threat or an increase in a previously identified threat;
- Evidence suggesting or indicating decrease in non-calf numbers and/or a decline in birth or survival rates (beyond what would be expected as populations approach their natural carrying capacity) is occurring in any humpback whale DPSs;
- Large contraction of spatial distribution or change in temporal distribution for any humpback whale DPS;
- Results from threats monitoring that indicate that a new threat has emerged, the magnitude of an existing threat has increased, and/or that the cumulative impacts from threats is likely greater than previously understood, such that it (they) may pose a threat to local or range-wide reproduction or survival of any humpback whale DPSs; or
- Evidence of a decline in a significant health factor (e.g., body condition, disease), beyond what would be expected as populations approach their natural carrying capacity, of any category of humpback whale (i.e., age group, sex, reproductive status) or a significant

change in behavior that could be attributed to a decline in health (e.g., habitat abandonment, changes in reproductive behavior, etc.).

Positive Triggers

- An increase in the estimated rate of survival or new estimates of birth rate which indicate that individuals from any humpback whale DPSs are not being negatively impacted by new threats or an increase in a previously identified threat;
- Evidence suggesting or indicating an increase in non-calf numbers, and/or high reproductive rate is occurring in any humpback whale DPSs;
- Maintenance or expansion of spatial distribution;
- Results from threats monitoring that indicate that no new threats have emerged or the strength of any existing threat has not increased; or
- Evidence of an improvement in a significant health factor of any category of humpback whale.

VI. REPORTS

As noted in the Post-Delisting Monitoring Plan Guidance (USFWS and NMFS 2008:4-3):

> "Effective PDM requires timely evaluation of data and responsiveness to observed trends. PDM data should be assessed at pre-determined intervals to determine whether the data collection protocols are functioning as anticipated and whether any changes in species protection are needed."

The Monitoring Plan Coordinator will work with NMFS Regional Coordinators to prepare informal annual reports to the Monitoring Plan Working Group (e.g., via email or conference call) that summarize available monitoring results and provide an overview of implementation of the monitoring plan, including any significant hurdles to implementation and/or changes in monitoring objectives, methods, or intensity.

NMFS will issue two "interim reports" consolidating and evaluating available monitoring data from three–year intervals within the 10-year monitoring timeframe (i.e., a report in 2019 covering results from 2016-2018, and a report in 2022 covering data from 2019-2021). The final four years of monitoring data and results (from 2022-2025) will be incorporated into a final monitoring report, described below. The Monitoring Plan Coordinator will work with the Monitoring Plan Working Group to develop details on standard content of these interim reports, as well as timing for posting them on the NMFS HQ website. As noted in section V/A. Review of Monitoring Data Relative to "Response Triggers" above, interim reports will also state whether any of the "response triggers" have been reached, determine whether the data collection protocols are functioning as anticipated or whether any changes are needed, and include an initial determination of any threats that may warrant further evaluation. NMFS is sensitive to investigator concerns about ensuring the reports do not preclude publication of findings in peer review literature, and these reports will not do so.

If NMFS convenes an ad hoc expert group to evaluate circumstances of one or more response triggers being met, NMFS will document the group's conclusions and recommendations in a report at that time.

At the end of the 10-year monitoring period, NMFS will prepare a final monitoring report that summarizes monitoring results and provides a final conclusion with regard to the following potential outcomes, as outlined in the PDMP guidance (USFWS and NMFS 2008):

- *PDM indicates that the DPSs remain secure without ESA protections.* If the DPSs appear to remain secure (e.g., their extinction risks have remained low, their demographic characteristics remain healthy, no population-level threats have emerged, and the DPSs do not meet the definition of either threatened or endangered species), conclusion of PDM is appropriate. However, as noted in the PDMP guidance (USFWS and NMFS 2008), there may be circumstances in which monitoring will continue, even after PDM is concluded, regardless of the PDM outcome. This is the case for humpback whale DPSs that occur in U.S. waters, which, under various provisions of the MMPA, will continue to be monitored following the monitoring period and their stock status will be reported regularly in SARs.

- *PDM indicates that the species may be less secure than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered.* Conditions that may indicate that the species could be less secure than anticipated at the time of delisting include, but are not limited to: if the level of residual threats has increased; new population-level threats are emerging; information indicates that population performance is not as good as it was at the time of delisting; and/or the population has begun to decline (but not at a rate that would indicate the listing of the species may be warranted). At a minimum, the duration of the monitoring period will be extended. Depending on specific circumstances, it may be appropriate to intensify monitoring (e.g., by adding parameters or by increasing the frequency of sampling) to increase the probability of detecting any future declines. It may be appropriate to initiate programs to determine the causes of unanticipated declines and/or implement additional conservation measures under existing regulatory authorities (other than the ESA).

- *PDM yields substantial information indicating threats are causing a decline in any of the humpback whale DPS' status since delisting, such that listing the DPS as threatened or endangered may be warranted.* In this instance, following the guidance in USFWS and NMFS (2008), and in addition to activities discussed in the previous paragraph, NMFS would initiate a formal status review to: assess changes in threats to those DPSs; assess changes in their abundances, productivity, survival, and distribution; and determine whether relisting is appropriate.

- *PDM documents a decline in any of the humpback whale DPS' probability of persistence, such that the DPS once again meets the definition of a threatened or endangered species under the Act*. As indicated in the PDMP guidance, in the event that PDM reveals that any of the humpback whale DPSs again meet the definition of a threatened (i.e., likely to become endangered in the foreseeable future throughout all or a significant portion of its range) or endangered species, then NMFS would take steps to promptly propose the DPS for relisting under the ESA in accordance with procedures in section 4(b)(5). Likewise, if the best available information indicates an emergency that poses a significant risk to the

well-being of any of the DPSs, NMFS would exercise its emergency listing authority under section 4(b)(7) accordingly.

NMFS will publish a notice of availability of the interim and final monitoring reports in the Federal Register, and will make the reports available on the NMFS website.

VII. FUNDING

Monitoring is a cooperative effort between: NMFS; other Federal agencies; State, tribal, and foreign governments; intergovernmental organizations (e.g., IWC); and non-governmental partners. Funding of monitoring presents a challenge for all partners committed to ensuring the continued viability of humpback whales following removal of ESA protections. To the extent feasible, NMFS intends to budget for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this PDMP should be construed as a commitment or requirement that any Federal agency will obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation.

VIII. ACKNOWLEDGMENTS

This monitoring plan was developed by NMFS in cooperation with the Hawaii Department of Land and Natural Resources, Alaska Department of Fish and Game, Massachusetts Division of Marine Fisheries, Glacier Bay National Park and Preserve, and the Hawaiian Islands Humpback Whale National Marine Sanctuary. The plan was revised based on public and peer review comment, and finalized following review and input by a team of staff from NMFS regional offices and from regional collaborators.

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APPENDIX A - Humpback Whale Protection and Monitoring under the MMPA and other Laws

Marine Mammal Protection Act (MMPA)

In the United States, all marine mammals, including humpback whales, are protected under the MMPA when they occur in waters under U.S. jurisdiction and protected from U.S. citizens and U.S. vessels on the high seas. Therefore, all members of the humpback whale species will continue to be protected under the MMPA even if the particular DPS to which they belong is not included on the ESA's List of Endangered and Threatened Wildlife. The MMPA established a moratorium on the taking (i.e., to harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect) of marine mammals with certain exceptions (e.g., taking incidental to certain activities).

Under the MMPA, the five currently-defined stocks of humpback whales in the U.S. (Western North Pacific, Central North Pacific, California/Oregon/Washington, American Samoa, and Gulf of Maine) were classified as strategic stocks and designated as depleted throughout their ranges because of their endangered status under the ESA. Upon the effective date of the final rule revising the status of humpback whales under the ESA, humpback whales that are listed as threatened or endangered will retain depleted status under the MMPA, and humpback whales that are not listed as threatened or endangered will not have depleted status under the MMPA. The DPSs that occur in waters under U.S. jurisdiction do not necessarily equate to the existing MMPA stocks. NMFS will conduct a review of humpback whale stock delineations in waters under U.S. jurisdiction to determine whether any stocks should be realigned in light of the ESA DPSs. Until such time, we will treat existing MMPA stocks that fully or partially coincide with a listed DPS as depleted, and stocks that do not fully or partially coincide with a listed DPS as not depleted for management purposes. Therefore, in the interim, we will treat the Western North Pacific, Central North Pacific, and California/Oregon/Washington stocks as depleted because they partially or fully coincide with ESA-listed DPSs, and we will treat the Gulf of Maine and American Samoa stocks as no longer depleted because they do not coincide with any ESA-listed DPS. Any changes in stock delineation or MMPA Section 117 elements (such as PBR or strategic status) will be reflected in future stock assessment reports, and the Scientific Review Groups and the public will be provided opportunity to review and comment.

Though the stocks of humpback whales that do not fully or partially coincide with ESA-listed DPSs (American Samoa and Gulf of Maine stocks) have lost their "depleted" status under the MMPA as a result of the change in ESA listing status, the fundamental MMPA protections and evaluation requirements common to all marine mammals remain in effect.

NMFS is required under section 117 of the MMPA to update Marine Mammal Stock Assessment Reports (SARs) annually for strategic stocks, and triennially for non-strategic stocks. SARs contain reviews of the population status and trend in abundance, estimate mortality and serious injury rates due to anthropogenic causes, and describe other factors that may affect stock status (NMFS 2016). Thus, SARs are reviewed and updated at least triennially independent of any monitoring requirements that may apply under Section 4(g)(1) of the ESA for humpback whales in U.S. waters, and estimates of humpback whale population abundance and trends, as well as anthropogenic-caused mortality and serious injury rates, can be made from the SARs.

Under Section 101 of the MMPA, Congress directed NMFS to authorize the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing, which follows a separate process) within a specified geographic region. Before issuing such authorizations, NMFS must make specific findings regarding the potential impacts of the action (e.g., the takings must have a negligible impact on the species and must not have an unmitigable adverse impact on the availability of the species for subsistence), set forth measures to ensure that the taking has the least practicable adverse impact on the species and its habitat, set forth monitoring and reporting requirements, and, in the case of activities that may affect the availability of a species for taking by subsistence users, include peer review of proposed monitoring plans. Thus, in those cases where persons who engage in activities that may take humpback whales (e.g., oil exploration) apply for incidental take authorizations, the MMPA permitting process provides a mechanism for NMFS to evaluate and to monitor the impacts occurring from such activities. NMFS anticipates that these kinds of activities will occur throughout the U.S. range of the humpback whale and that there will continue to be applications and authorizations of incidental take for U.S. citizens and corporations with related evaluation, monitoring, and reporting. Additionally, NMFS requires evaluation, monitoring, and reporting related to humpback whale research activities via its permitting and funding of research.

Section 118 of the MMPA governs the taking of marine mammals incidental to commercial fishing operations. The goal of this section was to reduce the incidental mortality or serious injury of marine mammals occurring in the course of commercial fishing operations to insignificant levels approaching a zero mortality and serious injury rate within seven years after its enactment. NMFS must annually classify all commercial fisheries as Category I, II, or III based on their levels of marine mammal interactions. There are registration requirements for Category I and II fishery participants and marine mammal interaction reporting requirements for all fishermen. Under section 118, Take Reduction Teams (TRTs) are developed to address bycatch of strategic marine mammal stocks in Category I and II fisheries, and non-strategic stocks in Category I fisheries if NMFS determines the fisheries have a high level of mortality and serious injury across a number of such marine mammal stocks. Currently, humpback whales are included under the Atlantic Large Whale Take Reduction Plan (ALWTRP) and the Pacific Offshore Take Reduction Plan (POCTRP). The POCTRP largely protects listed humpback whales from the Central America and Mexico DPSs, and so it not discussed further. However, information on the POCTRP is available online at:
http://www.nmfs.noaa.gov/pr/interactions/trt/poctrp.html

ALWTRP

The ALWTRP was developed in consultation with the Atlantic Large Whale Take Reduction Team (ALWTRT), which is a stakeholder team consisting of fishing industry representatives, scientists, environmental advocates, state and federal officials, and other interested parties. The ALWTRP is intended to reduce entanglement of right, fin, and humpback whales in fixed-gear fisheries (trap/pot and gillnet) from Maine to Florida. The ALWTRP has several components, including restrictions on where and how fishing gear can be set, research on whale populations

and behavior, research on fishing gear interactions and modifications, and outreach to inform and collaborate with fishermen and other stakeholders. In August 2012, staff of the NMFS Greater Atlantic Regional Fisheries Office (GARFO) completed a monitoring strategy for the ALWTRP (available online at: *http://www.greateratlantic.fisheries.noaa.gov/whaletrp/reports/5a_ALWTRP%20Monitoring%20Strategy.pdf*). The strategy incorporates a variety of measures that will assist in evaluating levels of compliance and overall effectiveness of the take reduction plan:

- Biological, oceanographic, and fishing gear analyses – population growth trends, large whale serious injury and mortality determinations, observed entanglement events over time, entangling gear identification, and oceanic conditions/trends related to large whales;
- Fishing industry practices and compliance indicators – utilizing observer data, quantifying enforcement efforts, gear characterization efforts; and
- Education/outreach measures – distribution of outreach guides and other information, issuing permit holder letters, ALWTRP website maintenance, trade-show participation, industry outreach meetings, ALWTRP trainings, direct communications, and publication of an annual compliance and effectiveness report.

Other U.S. and state regulations and guidelines

Numerous U.S. and state regulations and guidelines address impacts from whale watching activities. In Alaska, NMFS regulations prohibit vessels from approaching within 100 yards of a humpback whale in Alaska waters, and require vessels to maintain a slow, safe speed near humpback whales, and prohibit vessels from intercepting oncoming whales (a practice also known as "leap-frogging"). The regulations were originally promulgated under both ESA and MMPA authority. Concurrently with the publication of the final ESA listing rule, the Alaska approach regulations that currently appear in the part of the Code of Federal Regulations for endangered species (50 CFR Part 224) were recodified so they also appear in the part for threatened species (50 CFR Part 223), to protect the Western North Pacific DPS (endangered) and the Mexico DPS (threatened) under the ESA while they are feeding in Alaskan waters. The regulations were also set out with MMPA regulations (50 CFR Part 216) to protect all humpback whales in Alaska waters, not just the ESA-listed whales (81 FR 62018, September 8, 2016; 50 CFR 216.18). Glacier Bay National Park and Preserve (GBNPP) in Southeast Alaska has regulations (36 CFR 13, subpart N) that prohibit: operating a vessel within ¼ nautical mile of a whale, except for commercial fishing vessels actively trolling, setting, or pulling long lines, or setting or pulling crab pots; and, in designated whale waters, operating a motor vessel ($\geq$ 18 feet in length) less than 1 nautical mile from shore, or in narrower areas navigating outside of mid-channel, except vessels actively engaged in fishing or operating under sail. GBNPP regulations also set speed limits and total number of vessels per season in designated whale waters. The regulations in Alaska provide some protection to humpback whales in the non-listed Hawaii DPS, as well as the listed Western North Pacific and Mexico DPSs, while in their Alaska feeding areas.

In Hawaii, NMFS approach regulations prohibit vessels from approaching within 100 yards of a humpback whale, and prohibit aircraft from approaching within 1,000 feet of a humpback whale. The regulations were originally promulgated under ESA authority and therefore ceased to be in effect following the ESA final listing rule (whereby the Hawaii DPS was not be listed); however,

concurrently with the publication of the ESA final listing rule, NMFS published an interim final rule setting forth approach regulations under the MMPA to maintain protections for whales in Hawaii waters (81 FR 62010, September 8, 2016; 50 CFR 216.19). The Hawaiian Islands Humpback Whale National Marine Sanctuary has similar approach regulations within Sanctuary boundaries (15 CFR 922.184). The State of Hawaii also has regulations to protect humpback whales within state waters (Hawaiian Administrative Rules (HAR) § 13-244-40 (approach regulations), and HAR § 13-256-16 and 19 (thrill craft and parasail vessel prohibitions off South and West Maui)). These regulations provide some protection for individual humpback whales in the Hawaii DPS while they are in their breeding area.

Stellwagen Bank National Marine Sanctuary has whale approach guidelines that provide some protection for individuals from the West Indies DPS while they are in their feeding areas. NMFS has issued whale watching guidelines for the Gulf of Maine for whale-watching tours. In addition, Whale SENSE, a voluntary program promoting responsible viewing to minimize disturbance and protect whales from harassment, currently exists in New England, the mid-Atlantic, and Alaska.

International laws and guidelines

International Whaling Commission

The International Whaling Commission (IWC) was set up under the International Convention for the Regulation of Whaling (ICRW), signed in 1946. The IWC established an international moratorium on commercial whaling for all large whale species in 1982, which took effect in 1986 and affected all member (signatory) nations (paragraph 10e, IWC 2014). Part of the IWC's function is to set catch limits for commercial whaling. These have been set at zero since 1985. Since that time, the IWC's Scientific Committee has developed a stock assessment and catch limit methodology called the "revised management procedure," with the goal of providing information on catch limits consistent with maintaining sustainable populations. As of 2014, the IWC has maintained the zero catch limit for commercial whaling, which is a policy that has engendered considerable debate within the organization. The ICRW provides a process by which countries may object to specific provisions, and Norway and Iceland currently allow commercial whaling based on an objection and a reservation, respectively, to these catch limits. The IWC also develops catch limits for aboriginal subsistence whaling, including take of humpback whales in coastal areas of Greenland and the West Indies. The ICRW allows for signatory nations to harvest whales for scientific purposes through their own national permit process, although humpback whales have not been reported to have been taken under this process. However, unreported commercial whaling is not without precedent (Yablokov 1994, Ivaschenko and Clapham, 2015).

The IWC has been involved in the comprehensive assessment of humpback whales in the Southern Hemisphere since 1991, bringing together available information on distribution, migration, abundance, past exploitation and population (stock) structure.

The IWC's Conservation Committee was established to consider a number of emerging cetacean conservation issues, and its role continues to evolve. The Conservation Committee collaborates closely with the IWC's Scientific Committee to understand and address a range of threats to whales and their habitats. The varied work program includes:

- A strategy to provide an international forum for advice and support to the fast-growing whalewatching industry, including development of an online and ”live” whalewatch handbook.
- A ship strikes program that has developed a publicly accessible database, now being used to gather data and build understanding of where and why collisions occur between whales and ships. The ultimate aim is to develop targeted and practical mitigation measures.
- Development of the Conservation Management Plan concept, a flexible, collaborative blueprint for effective coordination of conservation work between local, national, regional and international stakeholders. Three Conservation Management Plans have already been instigated for some of the most at-risk whale populations and more are under consideration.
- A joint program with the Scientific Committee to consider the impact of marine debris on cetaceans. Two workshops have been held, reviewing existing research upon which a series of recommended actions were developed and endorsed by the IWC.

The IWC's Conservation Committee provides a forum for members of the IWC to report and share information on the measures being taken within their own countries to reduce and record incidences of ship strikes. In addition, the Conservation Committee has established a dedicated Ship Strikes Working Group to develop detailed proposals for mitigation of ship strike events and to co-ordinate work between member governments (*https://iwc.int/ship-strikes*). In 2010, the IWC's Ship Strikes Working Group held a joint workshop with scientists and representatives from ACCOBAMS (the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area), which reviewed the available information on ship strikes including mitigation measures for reducing ship strikes. It developed a number of important recommendations and these form the basis of the IWC's work plan to address this important issue.

Every year, the IWC's Scientific Committee considers methods of estimating the number of whales killed from ship strikes. The IWC is working in conjunction with other organizations such as the International Maritime Organization and has produced an information leaflet with further advice to reduce the risk of collision.

Many countries have regional or national strandings networks that maintain records of all stranded cetaceans and where possible ensure that sufficient data are collected to ascertain cause of death. In recognition that ship strikes are one of the reasons for cetacean strandings, a list of cetacean stranding networks updated through April 2011 is provided at *https://iwc.int/index.php?cID=873&cType=document*.

The IWC is working with a group of international experts to build a global network of professionally trained and equipped entanglement responders. The program began in autumn 2011. The first training workshop was held in March 2012. Since then it has reached more than 500 scientists, conservationists and government representatives from over 20 countries.

Two Sanctuaries are currently designated by the IWC, both of which prohibit commercial whaling. The first of these, the Indian Ocean Sanctuary, was established in 1979 and covers the whole of the Indian Ocean south to 55°S. The second was adopted in 1994 and covers the waters of the Southern Ocean around Antarctica.

The IWC is working with scientists, governments, NGOs and the whalewatching industry, to assess threats, identify and share best practice, and support responsible, sustainable whalewatching. The IWC Scientific Committee is studying the potential impact of repeated whalewatching on individual whales, their populations and their habitats. This ongoing research has led the IWC to develop principles and guidelines for whalewatching which have helped guide the development of whalewatching regulations around the world (*https://iwc.int/wwguidelines*). Measures introduced include limits on vessel numbers, speeds, approach distances and time spent with whales, and a variety of training and permit schemes. Over fifty countries have produced national guidelines or regulations for whalewatching. The IWC Whalewatching Working Group has produced a five-year whale watching strategy that has been adopted by the Commission (*https://iwc.int/private/downloads/ZibAR4HShR6wjYdH9C8NRw/AC-002s3%20IWC%20Whale%20Booklet_HR.pdf*), and is developing a Handbook for Whale Watching. This will be a web-based, living and evolving tool. It will support whalewatching operators, national and regional regulators, and others involved in the sector, to ensure whalewatching is sustainable now, and as it develops into the future.

Canada

In Canada, the North Pacific population of humpback whales is listed as threatened under the Species At Risk Act (SARA) (*http://www.sararegistry.gc.ca/approach/act/default_e.cfm*), so it is illegal to kill, harass, capture or harm it in any way. Critical habitat has been identified to the extent possible off Langara Island, southeast Moresby Island, Gil Island, and southwest Vancouver Island. These areas support feeding and foraging, and resting and socializing, and they are protected from destruction. A recovery strategy under SARA was published in 2013 (Fisheries and Oceans Canada 2013). The two goals of this recovery strategy are: (1) in the short term, to maintain at minimum, the current abundance of humpbacks in British Columbia (using best estimate of 2,145 animals (95% confidence limits 1,970 - 2,331 as presented in Ford *et al*. 2009)); and (2) in the longer-term, to observe continued growth of the population and expansion into suitable habitats throughout British Columbia. To meet these goals, threat and population monitoring, research, management, protection and enforcement, stewardship, outreach and education activities are recommended. Based on the need to assess population-level effects of threats and develop appropriate mitigation measures, activities to monitor and assess threats are given higher priority. An action plan to implement this recovery strategy will be completed within five years of final posting of the recovery strategy on the SAR Public Registry.

Humpback whales are also conserved and managed under authority of Canada's Fisheries Act (1985) and subsequent Marine Mammal Regulations (available at: *http://laws-lois.justice.gc.ca/eng/regulations/SOR-93-56/*). Except for people of First Nations, the MMR prohibits fishing for, or disturbance of, any marine mammal except as may be permitted by license.

Other

With regard to whale-watching impacts outside of U.S. waters, in the geographic area of the Brazil DPS, most whale-watching occurs in Abrolhos National Park, which is highly controlled, with a maximum number of boats of 15 per day. South Africa has whale-watching regulations that help protect humpback whales from the Gabon/Northwest Africa and Southeast

Africa/Madagascar DPSs. Further protection for the Southeast Africa/Madagascar DPS is provided by a voluntary code of conduct for operators in waters off Mozambique (though this is poorly upheld, with no formal regulations or enforcement) and recently developed guidelines for protection off Madagascar, which were passed as law in 2000. The East Australia DPS enjoys protection from whale-watching impacts through the whale-watching management program in Queensland, including whale and dolphin regulations for the Great Barrier Reef (*http://www.gbrmpa.gov.au/about-us/legislation-regulations-and-policies/whale-and-dolphin-watching-regulations*), as well as national whale-watching guidelines. For the Oceania DPS, New Zealand has marine mammal protection regulations (*http://www.legislation.govt.nz/regulation/public/1992/0322/latest/whole.html#DLM168839*), and Tonga and New Caledonia have whale-watching guidelines; in 2008, tour operators in New Caledonia signed a voluntary code of conduct that has significantly reduced the level of daily exposure to boats.

APPENDIX B: Monitoring Plan Working Group[1]

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[1] The NMFS National ESA Listing Coordinator (Marta Nammack) led the planning for and development of the PDMP, but is not expected to be involved in the implementation of the PDMP, so is not included in the above list.

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[i] We expect numerous other entities and individuals will be able to provide data and help with implementation of the PDMP, but this list includes those who have already agreed to collaborate with NMFS.