

# PacMAPPS: Toward Developing a Strategic Plan for Conducting Multispecies Cetacean and Ecosystem Assessment Surveys in the Pacific Ocean

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*A Multi-agency Plan to be developed by NMFS (NOAA Fisheries), Navy, BOEM and USFWS (Updated December 16, 2016)*

## Statement of Need

Level funding over the past years has resulted in a strong motivation to partner, within and across Federal agencies, so as to leverage funding, expertise, and infrastructure organized around common interests and needs. The agencies developing this plan have identified the common need to better understand distribution, abundance and stock structure of cetaceans and other protected species. Multispecies Cetacean and Ecosystem Assessment Surveys (CEAS) conducted aboard NOAA research vessels provide data to: (1) estimate cetacean abundance, trends and delineate stock structure, and (2) develop habitat-based density models for generating finer-scale predictions of cetacean density or occurrence and understand how these are changing with the environment. The former (1) are NOAA mandates. The latter (2) have proven valuable to the Navy and Bureau of Ocean Energy Management (BOEM) for environmental compliance and obtaining regulatory permission for conducting activities in particular regions, and for meeting associated environmental monitoring and reporting needs. CEAS also provide a platform of opportunity – utilized during many past Pacific CEAS cruises -- for collecting valuable seabird data of interest to NOAA, BOEM, the Navy, and the US Fish and Wildlife Service (USFWS), at a much reduced cost compared to dedicated seabird research efforts. NOAA provides the vast majority of resources -- in the form of ship-time and permanent-salaried scientists – needed to achieve CEAS goals; but additional support is needed for some at-sea data collection and post-survey analyses. NOAA, the Navy, and BOEM have partnered before to conduct past CEAS cruises. The aim here is to describe a strategic and proactive plan in the Pacific Ocean for these agencies to maintain and enhance these partnerships into the future, thereby ensuring they are able to meet future statutory and regulatory requirements. This report is intended as a “living document” that will be updated as the plan is continually revised.

## A Proposed Multi-agency Initiative for the Pacific: PacMAPPS

Representatives from NOAA, Navy, BOEM, and also USFWS (Appendix 1), convened for a one-day workshop in March 2016 to discuss common data and product needs, geographic areas of mutual interest, and the funding and schedule required to conduct survey efforts in those areas and generate data products. The key outcome of this meeting was to generate broad support for partnering to

develop multi-year strategic plan for conducting CEAS in the Pacific and generating relevant data products of value to the partnering agencies. The strategic plan would be modeled after the successes of the Atlantic Marine Assessment Program for Protected Species (AMAPPS). Workshop participants proposed naming the Pacific effort PacMAPPs: Pacific Marine Assessment Program for Protected Species.

Major benefits of multi-year planning include the ability to maximize leveraging from multiple agencies to generate data products that have the greatest utility for a diverse set of stakeholders at a minimum cost to each partner; and to align a schedule of surveys and data products with inter-agency permitting requirements. For example, the survey rotation discussed below is designed to align with the schedule of Navy permit renewals in different geographic regions.

## Toward Developing a Strategic Plan

During the workshop, participants discussed a number of key elements for developing a strategic plan to implement PacMAPPs. These included a timetable for surveys, geographic areas of shared interest, data and data products useful to the partnering agencies, and budgets.

### ***Timetable:***

It was generally agreed to develop a 5-year plan (surveys conducted annually from 2017 to 2021) consistent with BOEM and Navy funding cycles. One or two geographic areas would be surveyed annually, with surveys collectively encompassing *up to* approximately 180 sea days per year (e.g., two vessels x 90 days). Primary data products would be generated within approximately 1.5 years following data collection; thus data products for surveys conducted in 2017 – 2021 would be completed in approximately 2018 - 2022.

### ***Geographic areas of interest:***

NOAA Fisheries is responsible for assessing and managing protected species in all U.S Exclusive Economic Zones (EEZs) and the eastern tropical Pacific (Figure 1) to meet objectives of the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). The Navy and BOEM need abundance and distribution information for marine mammals and seabirds to address specific regulatory requirements (e.g., obtain permits, prepare environmental assessment reports) pertinent to conducting their activities at sea. Navy and BOEM activities occur in a subset of the U.S. EEZ areas for which NOAA Fisheries is responsible. The USFWS is responsible for assessing and managing seabirds in all U.S. EEZs, including Marine National Monuments and Wildlife Refuges in the Pacific. Geographic areas of shared interest are summarized in Table 1 and discussed in more detail in the plan outlined in Appendix 2. These are broadly defined at this time as the US part of the California Current, the Hawaiian and Mariana Archipelagos, and the Gulf of Alaska. Refining the extent of these areas for surveys will be an ongoing part of the strategic plan development.



Figure 1. Exclusive Economic Zones of the U.S., and the Eastern Tropical Pacific, where NOAA has responsibility to assess and manage marine mammal stocks and Distinct Population Segments under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA), respectively, and where USFWS has responsibility to assess and manage seabirds.

Table 1. Summary of Agency information needs or environmental assessment requirements in each U.S. EEZ area. NOAA and USFWS mandates apply in all U.S. EEZ areas; therefore those agencies are excluded from the table to eliminate redundancy. EEZ areas for which the Navy or BOEM do not have information needs are marked as '-'.

EEZ Area	BOEM	Navy
U.S. California Current	Southern WA to Mexico border; all areas outside of National Marine Sanctuaries.	Southern California testing and training area from Channel Islands south to into Baja California. Pacific Northwest testing and training area from northern CA to Canadian border. Transit corridor from southern CA to

EEZ Area	BOEM	Navy
		<i>Hawaii.</i>
Gulf of Alaska	<i>Cook Inlet oil &amp; gas leases and transport.</i>	<i>Limited region in central GoA.</i>
Bering Sea	-	-
Chukchi Sea	††	††
Beaufort Sea	††	††
Central Arctic	††	††
Hawaiian Archipelago	<i>Potential renewable energy leases near the main Hawaiian Islands. Also need winter baleen whale abundance.</i>	<i>Testing and training areas throughout the Hawaii EEZ. Also need winter baleen whale abundance.</i>
Mariana Archipelago	-	<i>The Mariana training area is quite large and extends into the Philippine Sea. Most activities occur in southern portion of archipelago (Guam to Farallon de Medinilla) and south of Guam outside of EEZ.*</i>
Wake	-	<i>HI-Guam transit corridor †</i>
Johnston	-	-
Palmyra & Kingman	-	-
Howland & Baker	-	-
Jarvis	-	-
American Samoa	-	-
Eastern Tropical Pacific	-	<i>Baja as part of Southern CA testing and training area.</i>

\* May be additional interest from other parts of Department of Defense, given increased operations by Marines and Air Force in the region.

† May be additional interest by Air Force given training operations on the Island.

†† BOEM or the Navy has activities or interests in some of these Arctic areas (e.g., oil leases, possible future naval training areas). However, participants at the March 2016 workshop agreed that the Arctic and its adjacent seas should likely be handled separately from the rest of the Pacific given emerging issues and more complex environmental and political consideration in that region.

**Information and data product needs:**

Data collected during CEAS primarily include line-transect (visual sightings), passive-acoustic, and photographic data and skin and blubber biopsy samples for cetaceans, strip transect (visual sightings) data for seabirds, physical and biological oceanographic data, and data on mid-trophic fishes and invertebrates (e.g., active acoustics, net sampling). These data are used directly to generate population abundance estimates for the surveyed areas, abundance trend estimates (if there is a long enough time series), delineate stock structure (based on photo ID data and genetic analysis of the biopsy samples), augment large-whale photo-identification catalogs (which ultimately contribute to knowledge about stock structure and large scale movement patterns), and provide time series information on seabird community composition, distribution, and abundance indices. Most of these cetacean metrics inform various elements (e.g., stock structure and abundance estimates) of stock assessment reports (SARs) that are required under the MMPA.

A variety of derived products have been generated from these data. Most notably, visual sightings data from survey cruises have been combined with oceanographic data to develop habitat models to predict cetacean density at relatively fine spatial and temporal scales. These analyses are particularly useful to agencies such as the Navy and BOEM requiring information about cetacean distribution and density in areas where human operations are occurring. It was broadly agreed at the workshop that spatial models to predict local occurrence and densities of cetaceans and seabirds were of universal interest to all stakeholders and should be considered the primary product output from the strategic plan.

**Budgets:**

Table 2 summarizes approximate estimated costs for 100 sea-days of conventional survey effort (an easily-scalable unit) in 2016 \$US. The total is approximately \$3.85 million USD, including salaries for NOAA scientists and coordinators, NOAA ship costs, annual equipment purchases, contracted seabird and marine mammal observers and acousticians, and basic post-survey data processing (not including statistical analyses to generate data products such as population size estimates or habitat-based density maps). Actual survey costs will vary somewhat depending travel associated with survey location and evolving research methods. For example, it will be more expensive for participating scientists based at Southwest Fisheries Science Center to travel for a Hawaiian survey than a California Current survey, and equipment and labor costs may increase as surveys incorporate new technologies (such as drifting passive acoustic arrays to improve data collection for deep-diving cetacean species, or unmanned aerial systems to improve data on species identification, group size and life history). Note, some costs in Table 2 are relatively fixed irrespective of survey length (e.g., survey prep, most equipment, post-cruise QA/QC), but the vast majority of costs not provided by NOAA/NMFS are labor costs, which do depend on the number of days at sea. Of the survey budget total, NOAA is able to provide approximately \$3.12 million (81% of survey budget total), leaving a shortfall of approximately \$728,000 per 100 sea-day unit, which would need to be provided by partnering agencies. Calculating and incorporating these costs into the overall budget scheme will be an important component of strategic plan development.

In addition to survey costs, funding is required to perform analyses to generate essential data products. Analyses to estimate cetacean population abundance, pursuant to marine mammal SARs, are conducted by NOAA analysts. Analyses to generate habitat-based animal-density surfaces – products to fulfill Navy and BOEM permitting requirements – are conducted in part by NOAA scientists (in kind support) and

contracted scientists with specific modeling expertise. The contract costs are projected to average about \$186,000 per year for cetacean modeling during the period 2018 - 2022 and \$120,000 per year for seabird modeling (Appendix 2). Analysis for a particular survey would be conducted during the year following the survey.

Table 2. Survey costs per 100 days of effort

	# units	Total Cost (2016 \$US, thousands)	Provided by NMFS (2016 \$US, thousands)
<b>Pre-survey Planning &amp; Logistics-</b>	Includes 25% Chief Scientist salary, 50% survey coordinator salary, and staff work toward logistics of specific survey components	\$199.44	\$199.44
<b>Survey equipment &amp; supplies</b>	Estimated based on prior surveys	\$29.15	-
<b>At-sea labor</b>			
Cruise leader	1	\$147.13	\$72.87
Marine mammal observers	6	\$328.44	-
Seabird observers	2	\$113.77	-
Cetacean acousticians	2	\$122.26	-
<b>Post-survey data &amp; sample QA/QC, documentation, archiving</b>			
Marine mammal data	30 days	\$19.68	\$19.68
Seabird data	24 days	\$15.74	\$15.74
Cetacean acoustic data	100 days	\$36.40	-
Cetacean tissue samples (extractions, mtDNA)	200 samples	\$23.60	-
<b>Science Costs</b>		<b>\$1,035.61</b>	<b>307.73</b>
<b>Ship time (NOAA Research Vessel)</b>		\$2,815.00	\$2,815.00
<b>Total</b>		<b>\$3850.61</b>	<b>\$3,122.73</b>
<b>Funding Required</b>			<b>\$727.88</b>

## Next steps

Appendix 2 contains an evolving template for a 5-year strategic plan, including approximate costs, for conducting rotational surveys throughout the Pacific and generating data products of interest to the partnering agencies. Inter-agency working group members will revise the plan periodically as needed.

## Appendix 1. Attendees at the March 2016 workshop

### NOAA, National Marine Fisheries Service (NMFS)

Richard Merrick, NMFS Chief Scientist

John Stein, Director, Northwest Fisheries Science Center (NWFSC)

Cisco Werner, Director, Southwest Fisheries Science Center (SWFSC)

Kristen Koch, Deputy Director, SWFSC

Lisa Ballance, Director, Marine Mammal & Turtle Division (MMTD), SWFSC

Robin LeRoux, Deputy Director, MMTD, SWFSC

Erin Oleson, Acting Director, Protected Species Division, Pacific Islands Fisheries Science Center (PIFSC)

Frank Parrish, Acting Director, Ecosystem Sciences Division, PIFSC

John Bengtson, Director, Alaska Marine Mammal Lab (MML), Alaska Fisheries Science Center (AFSC)

Jeff Moore, Leader, California Current Marine Mammal Assessment Program, SWFSC

Paul Wade, Cetacean Assessment & Ecology Program, AFSC

### Navy

Danielle Buonantony, N45 Chief of Naval Operations

Anurag Kumar, Living Marine Resources Program Manager

Andrea Ballaholden, Pacific Fleet

Laura Busch, US Fleet Forces Command

Sean Hanser, NAVFAC Pacific

Robert Uyeyama, NAVFAC Pacific

Andrew DiMatteo, Marine Resources Branch Manager, NAVFAC Atlantic

### BOEM

Rodney Cluck, Environmental Studies Program Director

Ann Bull, Chief of Sciences for Pacific Region

David Pereksta, Avian Biologist for Pacific Region

Greg Sanders, Marine Mammal Specialist for Pacific Region

### USFWS

Beth Flint, Supervisory Wildlife Biologist

Roberta Swift, Office of Migratory Birds- West Coast

## Appendix 2. Template for PacMAPPS Strategic Plan

### **Survey Plan and Estimated Costs/Contributions (Table S1)**

This plan is based on a 5-year cycle to match funding cycles of Navy and BOEM.

Four geographic areas are of mutual interest. All will be surveyed once per five-year cycle (Table S1), with the exception of the Hawaiian Islands (to be surveyed twice during the 5-year period, once in summer and once in winter, based on needs of one or more of the partnering agencies). The schedule (which study area in which year) is primarily influenced by the schedule of data needs of each of the partner agencies to meet their MMPA and ESA permitting requirements. Both Navy and BOEM require updated density models for cetaceans for the Hawaii and California Current study areas in 2020 and 2021 to meet agency permitting requirements. Navy will require updated data for the Mariana Archipelago and Gulf of Alaska in 2022 and 2023. The rotational survey schedule is also influenced by a pre-existing plan for the NOAA Ship *R/V Sette* in Hawaiian and western Pacific waters (Table S2), though the needs of partner agencies do require a departure from that schedule.

The geographic boundaries of the survey regions are based on NMFS' regions of responsibility but can be modified according to needs of Navy and/or BOEM. For example, the California Current survey region will likely be extended south to include Mexican waters seaward of the coast of Baja California and the winter survey of the Hawaiian Archipelago will be limited to the regions of greatest need, primarily surrounding the main Hawaiian Islands.

Tracklines (Figure S1) determine total sea day requirement (Ballance et al., In Press). CA Current and Hawaiian Archipelago tracklines are based on those used in past surveys. Marianas Archipelago and Gulf of Alaska tracklines use the same spatial grid spacing as used in the California Current (and can be modified based on future discussions of common needs).

Cost estimates and NOAA contributions for conducting surveys (Table S1) are based on scaling the labor portion of 100 sea-day units provided in Table 2 of the main document. These have been modified (e.g., summer 2017 Hawaiian Archipelago) or will be modified in Inter-agency Agreements (IAAs) on a case-specific basis according to survey-specific factors. Note, the cost estimates in Table S1 do not include analysis products, which are discussed separately below.

Table S1. Survey plan and timetable

Year	Areas surveyed	Number of sea-days†	Agency contributions (\$Million)					
			Total cost	NOAA	NOAA Short-fall	BOEM	Navy	USFWS
2017	Hawaiian Archipelago – Summer	187	\$6.92	\$5.64	\$1.28	\$0.65	\$0.29	TBD
2018	CA Current, including off Baja	142	\$5.33	\$4.34	\$0.99	\$0.39	TBD	TBD
2019	Main Hawaiian Islands – Winter	75	\$2.97	\$2.40	\$0.57	TBD	TBD	TBD
2020 <sup>#</sup>	Mariana Archipelago	138	\$5.19	\$4.22	\$0.97	TBD	TBD	TBD
2021 <sup>#</sup>	Gulf of Alaska (eastern half)	95	\$3.67	\$2.98	\$0.69	TBD	TBD	TBD

† Number of sea days per study area are tentative and may need to be reduced depending on funding available from each contributor

<sup>#</sup> Additional inter-agency discussion still needed to define total survey requirement in these regions.

Table S2. Planned research rotation for R/V Sette through the central and western Pacific U.S. waters.

Year	Location
<b>2017</b>	<i>Hawaiian Archipelago</i>
<b>2018</b>	<i>Mariana Archipelago</i>
<b>2019</b>	<i>American Samoa</i>
<b>2020</b>	<i>Hawaiian Archipelago</i>
<b>2021</b>	<i>Mariana Archipelago</i>
<b>2022</b>	<i>American Samoa</i>

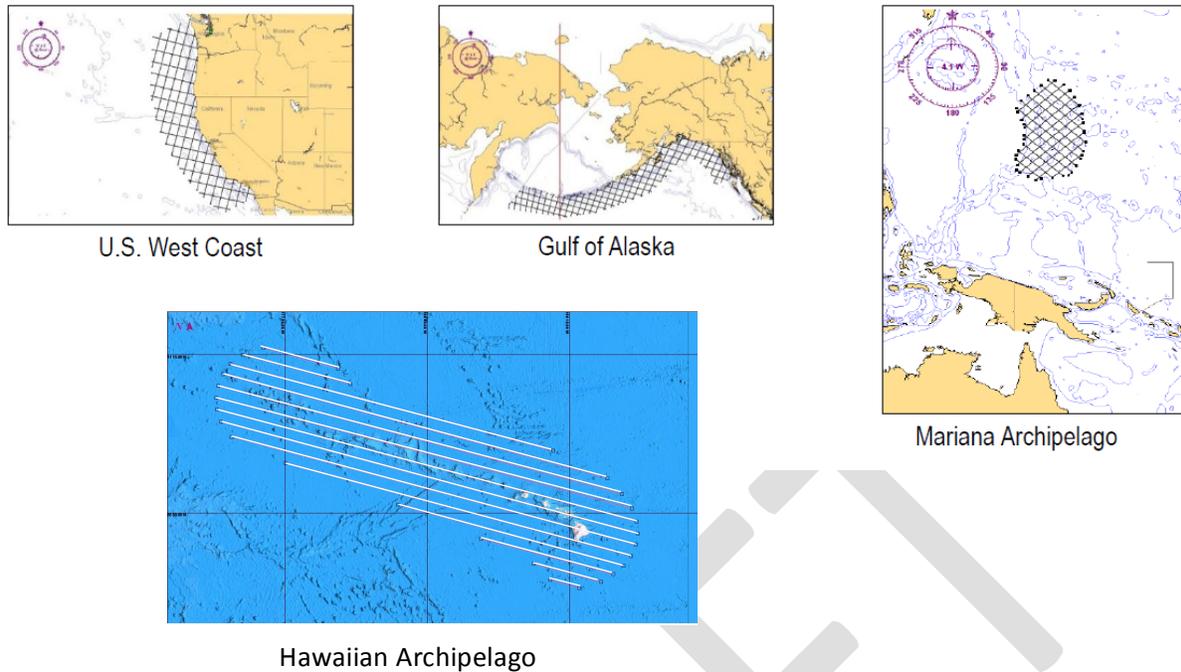


Figure. S1. Survey tracklines for the four geographic areas included as part of PacMAPPS.

### **Derived Analytical Products**

Valuable data are collected during CEAS efforts, but it is the analysis of these data and associated derived products that are of immediate interest. In particular, abundance and trend estimates, and predictive density surfaces for the most abundant species in each of the survey regions will be produced following each survey (Table S3). Predictive density surface products will incorporate data from all previous surveys conducted by NMFS in each region, when seasonally appropriate, i.e., summer data from Hawaii may not be used to produce density surfaces for winter. The budget in Table S3 reflects the cost of one NOAA salaried analyst and an additional contracted analyst to derive cetacean analyses such as maps of animal density, population abundance and trends (where data time series allow).

The combined survey and cetacean analytical costs are combined as summarized in Table S4. NOAA's contribution is 79% of the total.

Contracting costs to conduct analogous modeling for seabirds (e.g., abundance and density surfaces) are not included in these tables but these are estimated to be approximately \$120,000 per survey.

Table S3. Schedule and agency cost for **cetacean** analysis deliverables

Year	Geographic Region for which Derived Products will be Produced	Total costs (contracts + government salaries + travel)	Agency contributions		
			NOAA	BOEM	Navy
2017					
2018	Hawaiian Islands – Summer-Fall	\$315K	\$140K	\$150K	\$85K
2019	CA Current	\$325K	\$144K	\$150K	TBD
2020	Hawaiian Islands-Winter	\$334K	\$149K	TBD	TBD
2021	Marianas Archipelago	\$344K	\$153K	TBD	TBD
2022	Gulf of Alaska	\$355K	\$158K	TBD	TBD

Table S4. Total annual cost (survey + **cetacean** analyses) and agency contributions (\$million USD)

Year	Region surveyed	Region being analyzed	Survey + analysis costs	NOAA contribution	NOAA shortfall	BOEM contribution	Navy contribution
2017	Hawaiian Islands – Summer-Fall		\$6.92	\$5.64	\$1.28	\$0.65 to date	0.375
2018	CA Current	Hawaiian Islands – Summer-Fall	\$5.65	\$4.48	\$1.17	\$0.54	TBD
2019	Hawaiian Islands-Winter	CA Current	\$3.30	\$2.54	\$0.76	\$0.15	TBD
2020	Marianas Archipelago	Hawaiian Islands-Winter	\$5.52	\$4.37	\$1.15	TBD	TBD
2021	Gulf of Alaska	Marianas Archipelago	\$4.02	\$3.13	\$0.89	TBD	TBD
2022		Gulf of Alaska	\$0.36	\$0.16	\$0.20	TBD	TBD

### **Citations**

Ballance, L.T., M. Srinivasan, A. Henry, R. Angliss, L. Barre, J. Barlow, J. Bengtson, S. Bettridge, J. Bohnsack, S. Brown, P. Clapham, C. Fahy, M. Ford, L. Garrison, T. Gerrodette, N. LeBoeuf, J. Moore, E. Oleson, D. Palka, F. Parrish, J. Redfern, M. Simpkins, B. Taylor, P. Wade. In Press. A strategic plan for

conducting large geographic scale, ship-based surveys in support of the U.S. Marine Mammal Protection and Endangered Species acts. NOAA Technical Memorandum NMFS-F/SPO-xxx.

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