SUPPLEMENTAL INFORMATION REPORT

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Abstract: The National Marine Fisheries Service (NMFS) prepared this document to consider whether its proposal to modify the regulations and Letters of Authorization (LOAs) authorizing the take of marine mammals incidental to Navy training and testing activities conducted in the Hawaii-Southern California Training and Testing (HSTT) Study Area between 2018 and 2025 amounts to a substantial change to an existing proposed action or results in new significant environmental impacts beyond those evaluated in the 2018 HSTT Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) prepared by the U.S. Navy and subsequently adopted by NMFS, such that NMFS would have an obligation to prepare a supplemental analysis under the National Environmental Policy Act (NEPA). NMFS served as a cooperating agency during the development of the 2018 HSTT EIS/OEIS and adopted this EIS/OEIS to support issuance of five-year regulations and LOAs, and subsequently 7-year regulations and LOAs per Section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA). Upon publication, the modified MMPA regulations would replace the current regulations.

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1.0 Introduction and Background

The United States Navy (Navy) conducts military readiness activities pursuant to Title 10 United States Code (U.S.C.) Section 8062, which requires the Navy to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. Since the Navy historically has and will continue to conduct military readiness activities (herein "training") and research, development, testing and evaluation activities (herein "testing"), the Navy prepares analyses pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.) and Executive Order (EO) 12114 to analyze the environmental impacts of these activities. In addition and to the extent practical, the Navy integrates the requirements of NEPA with other laws and regulatory processes governing environmental protection so that all compliance procedures run concurrently, rather than consecutively. This includes coordination with the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) for requesting incidental take regulations and Letters of Authorization (LOAs) pursuant to the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1371(a)(5)(A)) and consultation pursuant to the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1536(a)(2)), and for consultation with the Office of National Marine Sanctuaries[1] (ONMS) under the National Marine Sanctuaries Act (NMSA; 16 U.S.C. 1434(d)).

To assess impacts of conducting training and testing activities within the Hawaii-Southern California Training and Testing (HSTT) Study Area[2], an Environmental Impact Statement (EIS)/ Overseas Environmental Impact Statement (OEIS) was prepared in accordance with NEPA and Executive Order (EO) 12114. This HSTT EIS/OEIS was completed in October, 2018 and following the publication of the final HSTT EIS/OEIS, the Navy signed a Record of Decision (ROD) in December, 2018. In conjunction with the development of the 2018 HSTT EIS/OEIS, the Navy requested regulations (herein "MMPA regulations") and LOAs[3] from NMFS for take of marine mammals incidental to the training and testing activities analyzed in the 2018 HSTT EIS/OEIS. When NMFS receives a request for incidental take of marine mammals, NMFS reviews the application to determine if it is adequate and complete and, if appropriate, issues incidental take authorizations pursuant to the MMPA. The purpose of issuing authorizations is to meet the requirements of an exception to the take prohibition in the MMPA and to ensure that the applicant's action complies with the MMPA and 50 Code of Federal Regulations (CFR) Part 216[4]. To authorize the incidental take of marine mammals, NMFS evaluates the best available scientific information to determine whether the taking would have a negligible impact on the affected marine mammal species or stocks and an unmitigable impact on their availability for subsistence uses. NMFS must also prescribe permissible methods of taking and other "means of effecting the least practicable adverse impact" on the affected species or stocks and their habitat, and monitoring and reporting requirements.

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[1] ONMS is within NOAA's National Ocean Service.

[2] The Study Area is comprised of established operating and warning areas across the north-central Pacific Ocean, from the mean high tide line in Southern California west to Hawaii and the International Date Line. The Study Area includes the at-sea areas of three existing range complexes (the Hawaii Range Complex, the Southern California (SOCAL) Range Complex, and the Silver Strand Training Complex), and overlaps a portion of the Point Mugu Sea Range (PMSR). Also included in the Study Area are Navy pierside locations in Hawaii and Southern California, Pearl Harbor, San Diego Bay, and the transit corridor on the high seas where sonar training and testing may occur.

[3] The Navy submitted the initial application in September, 2017 and an amended application in October, 2017 for regulations and LOAs.

[4] The regulations governing the taking and importing of marine mammals.

In addition to the authorization process under the MMPA, NMFS served as a cooperating agency during the preparation of this 2018 HSTT EIS/OEIS pursuant to 40 CFR 1501.6 because the scope of the Navy's proposed action and alternatives involve activities that have the potential to affect marine resources under NMFS jurisdiction and special expertise.

Following the completion of the 2018 HSTT EIS/OEIS, on December 27, 2018, NMFS published a final rule and issued two LOAs[5] to the Navy pursuant to Section 101(a)(5)(A) of the MMPA and 50 CFR Part 216. The final rule and LOAs were valid for a five-year period (December, 2018 through December, 2023) and authorize takes by Level A harassment and Level B harassment and a small number of takes by serious injury or mortality of marine mammals incidental to Navy training and testing activities (which qualify as military readiness activities[6]) in the HSTT Study Area. Since NMFS' consideration to grant or deny the Navy's request for MMPA regulations and LOAs is a major federal action under NEPA, NMFS participated substantially and meaningfully throughout the NEPA process to ensure the analysis in the 2018 HSTT EIS/OEIS was sufficient to satisfy its independent NEPA compliance obligations. Subsequently, NMFS adopted the 2018 HSTT EIS/OEIS and issued a separate ROD on October 30, 2018 associated with its determination to issue new MMPA regulations and LOAs to the Navy.

While the Navy was completing the 2018 HSTT EIS/OEIS and NMFS was in the final stages of preparing a final rule under the MMPA (as explained above), the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (FY19 NDAA) was signed into effect on August 13, 2018, amending the MMPA to extend the period that incidental take of marine mammals may be authorized for military readiness activities from five years to seven years (section 316 of Public Law No. 115-232). However, when the Navy submitted an application for regulations and LOAs in 2017 and NMFS published the HSTT proposed rule, NMFS was only able to consider issuing regulations and LOAs for up to five years in duration. In addition, the MMPA regulations and LOAs for the Navy's training and testing activities issued in 2013 were set to expire in December, 2018. Consequently, the short time period between the FY19 NDAA amendment to the MMPA and the deadline for obtaining new regulations and LOAs did not allow for Navy to modify its 2017 application to request extending the duration of MMPA authorization from five years to seven years or for NMFS to appropriately revise the HSTT proposed rule prior to December, 2018.

To address this change in duration for authorizations associated with military readiness activities per the FY19 NDAA amendment of the MMPA, the Navy submitted an application to NMFS on March 11, 2019, requesting an extension to the MMPA regulations and LOAs issued on December 21, 2018, which would provide MMPA authorization for a seven-year duration (2018 to 2025). On January 13, 2020, following publication of a proposed rule (84 FR 48388; September 13, 2019), NMFS finalized a Supplemental Information Report (SIR) to the 2018 HSTT EIS/OEIS. NMFS published a new final rule (85 FR 41780; July 10, 2020) and issued two LOAs[7] to the Navy pursuant to Section 101(a)(5)(A) of the MMPA and 50 CFR Part 216. The final rule and LOAs are valid for a seven-year period (effectively extending the expiration date

[5] One for training activities and one for testing activities.

[6] The Navy activities qualify as military readiness activities under 16 U.S.C. section 703, as applicable to MMPA incidental take authorizations pursuant to the NDAA for Fiscal Year 2004.

[7] One for training activities and one for testing activities.

from December 2023 to December 2025) and authorize takes by Level A harassment and Level B harassment and a small number of takes by serious injury or mortality of marine mammals incidental to Navy training and testing activities (which qualify as military readiness activities[8]) in the HSTT Study Area. Take by Level A harassment, Level B harassment, and serious injury or mortality from explosives authorized in the 2020 HSTT LOAs is included in Table 1 (training) and Table 2 (testing). Take by serious injury or mortality by vessel strike authorized in the 2020 HSTT LOAs is included in Table 3 (training and testing combined).

Table 1. Species and Stock-Specific Take Authorized from All Training Activities from December 21, 2018 through December 20, 2025, Excluding Take by Serious Injury or Mortality by Vessel Strike.

Species	Stock	7-Year Total		
		Level B Harassment	Level A Harassment	Serious Injury or Mortality (explosives only)
Blue whale	Central North Pacific	205	0	
	Eastern North Pacific	7,116	6	
Bryde's whale	Eastern Tropical Pacific	167	0	
	Hawaiian †	631	0	
Fin whale	CA/OR/WA	7,731	0	
	Hawaiian	197	0	
Humpback whale	CA/OR/WA	7,962	7	
	Central North Pacific	34,437	12	
Minke whale	CA/OR/WA	4,119	7	
	Hawaiian	20,237	6	
Sei whale	Eastern North Pacific	333	0	
	Hawaiian	677	0	
Gray whale	Eastern North Pacific	16,703	27	
	Western North Pacific	19	0	
Sperm whale	CA/OR/WA	8,834	0	
	Hawaiian	10,341	0	
Dwarf sperm whale	Hawaiian	84,232	215	
Pygmy sperm whale	Hawaiian	33,431	94	
Kogia whales	CA/OR/WA	38,609	149	
Baird's beaked whale	CA/OR/WA	8,524	0	

[8] The Navy activities qualify as military readiness activities under 16 U.S.C. section 703, as applicable to MMPA incidental take authorizations pursuant to the NDAA for Fiscal Year 2004.

Blainville's beaked whale	Hawaiian	23,491	0	
Cuvier's beaked whale	CA/OR/WA	47,178	0	
	Hawaiian	7,898	0	
Longman's beaked whale	Hawaiian	82,293	0	
Mesoplodon species (beaked whale guild)	CA/OR/WA	25,404	0	
Bottlenose dolphin	California Coastal	1,295	0	
	CA/OR & WA Offshore	201,619	13	
	Hawaiian Pelagic	13,080	0	
	Kauai & Niihau	500	0	
	Oahu	57,288	10	
	4-Island	1,052	0	
	Hawaii	291	0	
False killer whale	Hawaii Pelagic	4,353	0	
	Main Hawaiian Islands Insular	2,710	0	
	Northwestern Hawaiian Islands	1,585	0	
Fraser's dolphin	Hawaiian	177,198	4	
Killer whale	Eastern North Pacific Offshore	460	0	
	Eastern North Pacific Transient/West Coast Transient	855	0	
	Hawaiian	513	0	
Long-beaked common dolphin	California	784,965	99	
Melon-headed whale	Hawaiian Islands	14,137	0	
	Kohala Resident	1,278	0	
Northern right whale dolphin	CA/OR/WA	357,001	57	
Pacific white-sided dolphin	CA/OR/WA	274,892	19	
Pantropical spotted dolphin	Hawaii Island	17,739	0	
	Hawaii Pelagic	42,318	0	
	Oahu	28,860	0	

	4-Island	1,816	0	
Pygmy killer whale	Hawaiian	35,531	0	
	Tropical	2,977	0	
Risso's dolphin	CA/OR/WA	477,389	45	
	Hawaiian	40,800	0	
Rough-toothed dolphin	Hawaiian	26,769	0	
	NSD[1]	0	0	
Short-beaked common dolphin	CA/OR/WA	5,875,431	307	4
Short-finned pilot whale	CA/OR/WA	6,341	6	
	Hawaiian	53,627	0	
Spinner dolphin	Hawaii Island	609	0	
	Hawaii Pelagic	18,870	0	
	Kauai & Niihau	1,961	0	
	Oahu & 4-Island	10,424	8	
Striped dolphin	CA/OR/WA	777,001	5	
	Hawaiian	32,806	0	
Dall's porpoise	CA/OR/WA	171,250	894	
California sea lion	U.S.	460,145	629	5
Guadalupe fur seal	Mexico	3,342	0	
Northern fur seal	California	62,138	0	
Harbor seal	California	19,214	48	
Hawaiian monk seal	Hawaiian	938	5	
Northern elephant seal	California	241,277	490	

Note: CA/OR/WA – California/Oregon/Washington
[1]NSD: No stock designation

Table 2. Species and Stock-Specific Take Authorized from All Testing Activities from December 21, 2018 through December 20, 2025, Excluding Take by Serious Injury or Mortality by Vessel Strike.

Species	Stock	7-Year Total		
		Level B Harassment	Level A Harassment	Serious Injury or Mortality (explosives only)
Blue whale	Central North Pacific	93	0	

	Eastern North Pacific	5,679	0	
Bryde's whale	Eastern Tropical Pacific	97	0	
	Hawaiian	278	0	
Fin whale	CA/OR/WA	6,662	7	
	Hawaiian	108	0	
Humpback whale	CA/OR/WA	4,961	0	
	Central North Pacific	23,750	19	
Minke whale	CA/OR/WA	1,855	0	
	Hawaiian	9,822	7	
Sei whale	Eastern North Pacific	178	0	
	Hawaiian	329	0	
Gray whale	Eastern North Pacific	13,077	9	
	Western North Pacific	15	0	
Sperm whale	CA/OR/WA	7,409	0	
	Hawaiian	5,269	0	
Dwarf sperm whale	Hawaiian	43,374	197	
Pygmy sperm whale	Hawaiian	17,396	83	
Kogia whales	CA/OR/WA	20,766	94	
Baird's beaked whale	CA/OR/WA	4,841	0	
Blainville's beaked whale	Hawaiian	11,455	0	
Cuvier's beaked whale	CA/OR/WA	30,180	28	
	Hawaiian	3,784	0	
Longman's beaked whale	Hawaiian	41,965	0	
Mesoplodon species (beaked whale guild)	CA/OR/WA	16,383	15	
Bottlenose dolphin	California Coastal	11,158	0	
	CA/OR & WA Offshore	158,700	8	
	Hawaiian Pelagic	8,469	0	
	Kauai & Niihau	3,091	0	
	Oahu	3,230	0	
	4-Island	1,129	0	

	Hawaii	260	0	
False killer whale	Hawaii Pelagic	2,287	0	
	Main Hawaiian Islands Insular	1,256	0	
	Northwestern Hawaiian Islands	837	0	
Fraser's dolphin	Hawaiian	85,193	9	
Killer whale	Eastern North Pacific Offshore	236	0	
	Eastern North Pacific Transient/West Coast Transient	438	0	
	Hawaiian	279	0	
Long-beaked common dolphin	California	805,063	34	
Melon-headed whale	Hawaiian Islands	7,678	0	
	Kohala Resident	1,119	0	
Northern right whale dolphin	CA/OR/WA	280,066	22	
Pacific white-sided dolphin	CA/OR/WA	213,380	14	
Pantropical spotted dolphin	Hawaii Island	9,568	0	
	Hawaii Pelagic	24,805	0	
	Oahu	1,349	0	
	4-Island	2,513	0	
Pygmy killer whale	Hawaiian	18,347	0	
	Tropical	1,928	0	
Risso's dolphin	CA/OR/WA	339,334	24	
	Hawaiian	19,027	0	
Rough-toothed dolphin	Hawaiian	14,851	0	
	NSD[1]	0	0	
Short-beaked common dolphin	CA/OR/WA	3,795,732	304	4
Short-finned pilot whale	CA/OR/WA	6,253	0	
	Hawaiian	29,269	0	

Spinner dolphin	Hawaii Island	1,394	0	
	Hawaii Pelagic	9,534	0	
	Kauai & Niihau	9,277	0	
	Oahu & 4-Island	1,987	0	
Striped dolphin	CA/OR/WA	371,328	20	
	Hawaiian	16,270	0	
Dall's porpoise	CA/OR/WA	115,353	478	
California sea lion	U.S.	334,332	36	
Guadalupe fur seal	Mexico	6,167	0	
Northern fur seal	California	36,921	7	
Harbor seal	California	15,898	12	
Hawaiian monk seal	Hawaiian	372	0	
Northern elephant seal	California	151,754	187	

Note: CA/OR/WA – California/Oregon/Washington
[1] NSD: No stock designation

Table 3. Species and Stock-Specific Take by Serious Injury or Mortality by Vessel Strike Authorized for Training and Testing Activities Combined from December 21, 2018 through December 20, 2025[1] in the 2020 HSTT final rule.

Species	Stock	Seven-Year Take by Serious Injury or Mortality (Three takes total)
Fin whale	CA/OR/WA stock	2
Gray whale	Eastern North Pacific	2
Humpback whale	CA/OR/WA (Mexico DPS)	1
	Central North Pacific	2
Sperm whale	Hawaii	1
Blue whale	Eastern North Pacific	1

[1] Incidental take by serious injury or mortality from vessel strikes is limited to a total of three large whales over the total seven-year period during training and testing activities combined from the species listed in Table 3. Of the three total takes, no more than one or two whales can be taken by vessel strike from each species (as indicated) listed in Table 3.

On March 31, 2022, NMFS received an adequate and complete application (2022 Navy application) from the Navy requesting that NMFS modify the existing regulations and LOAs to authorize two additional takes of large whales by serious injury or mortality by vessel strike (five strikes total) over the remainder of the HSTT authorization period (through December 20, 2025). The existing regulations and LOAs authorize the take of three large whales by serious injury or mortality by vessel strike (Table 3).

The Navy's 2022 request is based upon new information regarding U.S. Navy vessel strikes off the coast of Southern California. As described in the 2022 Navy application, in 2021, two separate U.S. Navy vessels struck unidentified large whales off the coast of Southern California on two separate occasions, one whale in June 2021 and one whale in July 2021. Since submitting its application, on May 20, 2023, a Navy aircraft carrier struck and killed one large whale in SOCAL. NMFS identified the whale as either a sei or fin whale.

NMFS reviewed the Navy's application and prepared a proposed rule (88 FR 68290; October 3, 2023) that, if finalized, would authorize two additional takes of large whales by serious injury or mortality by vessel strike in the HSTT Study Area (five takes total) through December 2025 from the same training and testing activities analyzed in the 2018 HSTT EIS/OEIS. NMFS published a proposed rule in the *Federal Register* (FR) for public review and comment on September 13, 2019 (84 FR 48388). Nearly all mitigation, monitoring, and reporting measures in the proposed rule remain unchanged from the 2020 HSTT final rule (83 FR 66846; December 27, 2018) with the exception of two additional mitigation measures, revision of two existing mitigation measures, and an additional reporting measure resulting from discussions between the Navy and NMFS. Take by serious injury or mortality by vessel strike proposed for authorization in the proposed rule (88 FR 68290; October 3, 2023) is included in Table 4.

Table 4. Species and Stock-Specific Take by Serious Injury or Mortality by Vessel Strike for Training and Testing Activities Combined Proposed for Authorization from December 21, 2018 through December 20, 2025 in the 2023 HSTT proposed rule (88 FR 68290; October 3, 2023).[1]

Species	Stock	Seven-Year Take by Serious Injury or Mortality	Increase in Seven-Year Take by Serious Injury or Mortality from the 2020 HSTT Final Rule (Five takes total)
Fin whale	CA/OR/WA stock	4	+2
Gray whale	Eastern North Pacific	4	+2
Humpback whale	Mainland Mexico-CA/OR/WA[2]	2	+1
Blue whale	Eastern North Pacific	1	0
Sei whale	Eastern North Pacific	1	+1

Note: NMFS proposed authorizing one take by serious injury or mortality of sei whale over the seven-year period of the proposed regulations. NMFS did not authorize take of sei whale in the 2020 HSTT LOAs (Table 3). NMFS did not proposed take by serious injury or mortality of sperm whale in the proposed regulations. Take by serious injury or mortality of sperm whale was authorized in the 2020 HSTT LOAs (Table 3).

[1] Incidental take by serious injury or mortality from vessel strikes would be limited to a total of five large whales over the total seven-year period during training and testing activities combined from the species listed in Table 4. Of the five total takes, no more than one, two or four whales can be taken by vessel strike from each species (as indicated) listed in Table 4.

[2] In the 2020 HSTT final rule, take of humpback whale by serious injury and mortality by vessel strike in SOCAL was attributed to the former CA/OR/WA stock and the Mexico DPS. In SOCAL, the takes of individuals from the former CA/OR/WA stock that were authorized in the 2020 HSTT final rule would be anticipated to be of individuals from the new Central America/Southern Mexico-CA/OR/WA and Mainland Mexico-CA/OR/WA stock. Please see the 2023 HSTT proposed rule for an explanation as to why take by serious injury or mortality by vessel strike is not anticipated to occur to the new Central America/Southern Mexico-CA/OR/WA.

2.0 Purpose and Scope of this Report

The primary purpose of this SIR is to evaluate and document whether NMFS has a duty to prepare a supplemental analysis under NEPA if it grants the Navy's request for modified MMPA regulations and LOAs (*i.e.*, including two additional takes by serious injury or mortality by vessel strike (five takes total)). This evaluation is presented and discussed in section 3.1 and 3.2. NMFS also evaluated whether it has a corresponding duty to reinitiate formal consultation under Section 7 of the ESA based on the re-initiation triggers set forth in the Biological Opinion issued on December 10, 2018[9] and whether the consultation completed under section 304(d) of the National Marine Sanctuaries Act (NMSA) remains valid. This evaluation is presented and discussed in section 3.3.

The Council on Environmental Quality (CEQ) regulations, at 40 CFR 1502.9(c) states that Agencies "Shall prepare supplements to either draft or final environmental impact statements if: (i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or (ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." Based on this requirement, this SIR addresses whether changes to the proposed action are "substantial" and if the new circumstances and information are "significant". A substantial change would mean that the difference between the proposed action evaluated in the 2018 HSTT EIS/OEIS and the specified activities identified in the Navy's 2022 application for two additional takes by serious injury or mortality by vessel strike is important to the relevant environmental concerns because the change did not receive a thorough analysis in the 2018 HSTT EIS/OEIS or the change would lead to significant impacts not considered in the 2018 HSTT EIS/OEIS. To determine significance associated with new circumstances and information, NMFS relied on criteria outlined in 40 CFR 1508.27 and the Companion Manual for NOAA Administrative Order 216-6A, Section 7C.

3.0 Environmental Review Summary and Determinations

3.1 Changes to the Proposed Action

This section discusses whether NMFS' proposal to grant the Navy's request for modified MMPA regulations and LOAs to authorize two additional takes by serious injury or mortality by vessel strike (five takes total) represents a substantial change in the proposed action analyzed in the 2018 HSTT EIS/OEIS. As explained in the 2018 HSTT EIS/OEIS, the Navy's proposed action is conducting training and testing activities in the HSTT Study Area into the reasonably foreseeable future. The Navy validated their operational requirements and determined there is no anticipated change in the training and testing activities as analyzed in the 2018 HSTT EIS/OEIS under the action alternatives.

Since NMFS' proposed action would authorize take of marine mammals incidental to a subset of the activities analyzed in the 2018 HSTT EIS/OEIS and as specified in the Navy's MMPA application, these components of the Navy proposed action are directly relevant to NMFS' proposed action. The purpose of NMFS' action, which is a direct outcome of the Navy's request, is to evaluate Navy's application pursuant to section 101(a)(5)(A) of the MMPA and 50 CFR Part 216 and issue an authorization, if appropriate. The need for NMFS' action is to consider the impacts of the Navy's activities on marine mammals and their habitat and ultimately authorize the incidental take in compliance with the MMPA if the requirements of section 101(a)(5)(A) are satisfied. In addition, the Navy proposed no changes to their specified activities or the geographical region in which those activities take place. However, if finalized, the modified

[9] Formal consultation must be re-initiated to amend an existing Biological Opinion if one or more of the specified triggers in the incidental take statement is met.

regulations and LOAs would require Navy to implement several new and modified mitigation measures in comparison to those included in the 2018 HSTT EIS/OEIS.

The 2018 HSTT EIS/OEIS included extensive discussion of the potential for take by serious injury or mortality by vessel strike. However, the 2018 HSTT EIS/OEIS does not conclude that a certain number of takes by serious injury or mortality by vessel strike could occur. Instead, as explained in section 3.7.3.4.1 (Impacts from Vessels and In-Water Devices), the 2018 HSTT EIS/OEIS concludes that "based on the Appendix F probabilities and in cautionary acknowledgment that the probability of a ship strike, although low, could occur over a five-year authorization, the Navy is electing to request a small number of takes to select large whale stocks from vessel strikes for HSTT. The exact magnitude of this request will be determined at the conclusion of the Marine Mammal Protection Act and Endangered Species Act consultations with NMFS."

As described in Section 1.0 of this SIR, NMFS published a proposed rule (88 FR 68290; October 3, 2023) that, if finalized, would authorize two additional takes of large whales by serious injury or mortality by vessel strike in the HSTT Study Area (five takes total) through December 2025 from the same training and testing activities analyzed in the 2018 HSTT EIS/OEIS. These additional takes could be of fin whale (CA/OR/WA stock), gray whale (Eastern North Pacific stock), humpback whale (Mainland-Mexico-CA/OR.WA stock), blue whale (Eastern North Pacific stock), or sei whale (Eastern North Pacific stock) (Table 4). The number of strikes authorized in the 2020 HSTT final rule, by species and stock, are indicated in Table 3.

Take by serious injury or mortality by vessel strike was analyzed in Chapter 3.7 and Appendix F of the 2018 HSTT EIS/OEIS. Appendix F provides a Poisson distribution of the potential for vessel strike of marine mammals, and shows the outcome for the probability of 0, 1, 2, or 3 strikes from 2019-2023 (section F.3). Using that analysis, Chapter 3.7 indicates that the Navy requests a "small number of takes to select large whale stocks from vessel strike for the HSTT Study Area". Neither Chapter 3.7 nor Appendix F indicate the exact number of strikes anticipated to occur, nor does it indicate the species or stocks most likely to be struck (other than "large whale stocks" as noted previously). Therefore, while the 2018 HSTT EIS/OEIS only includes results of the Poisson distribution for up to three vessel strikes, and five takes by serious injury or mortality analyzed in the 2023 HSTT proposed rule is higher than the three takes analyzed in the 2020 HSTT final rule (two additional takes by serious injury or mortality), this additional take still falls within the "small number of takes to select large whale stocks" stated in the 2018 HSTT EIS/OEIS. Based on this evaluation, NMFS determined that the proposal to modify the MMPA regulations and issue new LOAs (effective from publication date of the final rule through December 20, 2025) to the Navy authorizing two additional takes by serious injury or mortality by vessel strike would not result in substantial changes in the proposed action described and evaluated in the 2018 HSTT EIS/OEIS that are relevant to environmental concerns.

Cumulative impacts to marine mammals are analyzed in Chapter 4.4.7.4.2 of the 2018 HSTT EIS/OEIS. Current sources of cumulative impacts and their potential impacts analyzed in the 2018 HSTT EIS/OEIS remain substantially the same and valid. In general, bycatch, vessel strikes, and entanglement are leading causes of injury and direct mortality to marine mammals throughout the region of influence. Ocean noise is already significantly elevated over historic, natural levels, and acoustic stressors (underwater explosions and sonar, as well as increased Navy vessel noise) associated with the action could also result in additive acoustic impacts on marine mammals. Other current and future actions such as characterization, construction, and operation of offshore wind energy projects; seismic surveys; and construction, operation, and removal of oil and gas facilities could result in underwater sound levels that could cause behavioral harassment, TTS, PTS, or injury. In summary, the aggregate impacts of past, present, and other reasonably foreseeable future actions continue to have significant impacts on some marine mammal species in the Study Area. Safety, security, and operational considerations would preclude some training and testing activities in the immediate vicinity of other actions, reducing the likelihood of simultaneous or overlapping exposure. The could contribute incremental stressors to individuals, which would further compound effects on a given individual already experiencing stress. However, with the implementation of standard operating procedures reducing the likelihood of overlap in time and space with other stressors and the implementation of mitigation measures reducing the likelihood of impacts, the incremental stressors anticipated are not anticipated to be significant.

The 2018 HSTT EIS/OEIS determined that the use of sonar and other transducers, air guns, and pile driving may cause take Level A or Level B harassment under the MMPA, and the use of explosives may cause take by Level A harassment, Level B harassment, or mortality under the MMPA. Additionally, vessel strike could result in Level A harassment or mortality of large whales under the MMPA. While a few individual marine mammals may experience injury or mortality, population-level impacts are not expected.

3.2 New Information and Circumstances

This section identifies and evaluates whether new or updated circumstances and information since the completion of the 2018 HSTT EIS/OEIS are significant with respect to relevant environmental concerns and impacts evaluated in the 2018 HSTT EIS/OEIS.

NMFS 2024 Updated Technical Guidance

Since publication of the 2018 HSTT EIS/OEIS, NMFS has updated our Technical Guidance (NMFS, 2024) containing updated acoustic criteria for auditory injury (89 FR 36762). The Technical Guidance provides updated auditory injury thresholds, where appropriate, as well as revised weighting functions, in some cases. For impulsive sources, the Updated Technical Guidance's auditory injury thresholds generally remain identical or are higher compared to our 2018 Technical Guidance, meaning that received levels would need to be higher in order for marine mammals to be expected to incur auditory injury. The exceptions are for phocid pinnipeds (PW), where the cumulative SEL threshold, in the Updated Technical Guidance, is 2 dB lower and for otariid pinnipeds (OW) where the peak sound pressure level threshold is 2 dB lower and the cumulative SEL threshold is 18 dB lower. As for the Updated Technical Guidance's weighting functions, for MF cetaceans (now called HF cetaceans in the updated document) and HF cetaceans (now called VHF cetaceans in the updated document), the weighting functions reflect a higher susceptibility to auditory injury at frequencies below 10 kHz, as compared to the 2018 Technical Guidance. Other minor changes/shifts to weighting functions (e.g., for LF cetaceans, PW pinnipeds, OW pinnipeds) were also included. This new information was not available in a timeframe in which NMFS could have incorporated it into the quantitative analysis supporting this final rulemaking or through a supplemental EIS/OEIS; however, NMFS did consider the information qualitatively. While these changes in the auditory injury thresholds and weighting functions could result in minor increases in PTS exposure estimates for some species, given the conservative assumptions built into the take estimate methodology, they would not be expected to result in meaningful, if any, changes in take estimates and would not be expected to change any of the findings in the 2018 EIS/OEIS.

New Literature

The scientific community continues to conduct research to generate new data in an effort to expand and improve our understanding of the marine environment. Since the publication of the 2018 HSTT EIS/OEIS, NMFS and the Navy have reviewed numerous new publications relevant to the analysis of impacts described in the 2018 HSTT EIS/OEIS. We have identified additional references that are relevant to the analysis of impacts described in the 2018 HSTT EIS/OEIS but were published after the EIS/OEIS was issued. The majority of these references are peer-reviewed journal articles and present the results of ongoing and new research on the topics of effects of vessel strike; lookout effectiveness; hearing, vocalization and masking; hearing loss (TTS and PTS); behavioral reactions; methodology for assessing acoustic impacts; physiological responses and stress; stranding; population consequences of disturbance and cumulative stressors; methodology for assessing acoustic impacts; and aircraft noise. While there are additional research papers pertaining to marine resources, the studies outlined below were chosen due to their relevance to the analysis of the proposed action and particularly to marine mammal effects.

Vessel Strike

Dunlop (2024) studied migrating east Australian humpback whales' response to approaching vessels to determine if individuals exhibited an avoidance response. While some select groups did display changes in their movements, the sampled collective did not display any consistent vessel avoidance response. Furthermore, the degree of avoidance was lower as vessels approached at faster speeds. Overall, the results showed that humpbacks were generally unresponsive to approaching vessels regardless of the speed or noise level at which they approached. Female-calf pairs proved to be the biggest exception to this pattern; though this demographic did not exhibit a consistent response as a whole, these pairs were more likely to change their travel pattern more than any other group. Due to the lack of response from the population, the results suggest that implementation of vessel strike avoidance protocols is critical for successfully conserving large whale populations.

Redfern *et al.* (2024) developed a new metric for analyzing vessel strike risk reduction ("PLETHd") and applied it to North Atlantic right, humpback, fin, and sei whale distributions along the U.S. East Coast. The metric is calculated using three parameters: the relationship between vessel speed and the probability that a strike is lethal, vessel transit distance, and whale distributions. The authors compared the impact of a 14 kn (25.9 km/hr) vs. 10 kn (18.5 km/hr) speed reduction and found that only the 10 km (18.5 km/hr) reduction substantially reduced risk. The authors also found that applying a 10 kt (18.5 km/hr) speed restriction within multiple whale species' critical habitat zones was almost as effective as enacting the same speed restriction along the entire East Coast EEZ. The results suggest that 10 kn (18.5 km/hr) speed restrictions are a robust method for reducing vessel strike risk and that vessel restrictions within high-density core areas of a marine mammal's habitat can be highly impactful.

Crum *et al.* (2019) analyzed a modeling framework using encounter theory to estimate the risk of lethal commercial vessel strike to North Atlantic right whales. Seasonal mortality rates of right whales decreased by 22 percent on average after a speed rule was implemented, indicating that the rule is effective at reducing lethal collisions. The rule's effect on risk was greatest where right whales were abundant and vessel traffic was heavy but varied considerably across time and space.

Keen *et al.* (2019) compared vessel traffic patterns in the Southern California Bight, San Francisco, and the Pacific Northwest and found fin whales had a higher risk of nighttime vessel strikes with the nighttime risk being double daytime risk. The authors concluded that the shipping lanes contained 14 percent of all traffic volume and contributed 13 percent of all strike risk similar to conclusions reached by Rockwood *et al.* (2017). However, the authors also point out that a California Current Ecosystem (CCE) wide shipping speed reductions would not be practicable. Instead, they proposed 24-hour speed restrictions around and within shipping lanes would be more effective and feasible than nighttime only speed restrictions elsewhere. Keen *et al.* (2019b) reported high fin whale habitat suitability throughout the Southern California Bight, in particular inshore in winter and in southern portions of the Bight, which include HSTT SOCAL Study Area.

Leaper (2019) estimated that a global 10 percent reduction in shipping speeds could result in a reduction of underwater sound associated with shipping by approximately 40 percent and vessel strike risk by around 50 percent by 2050. The vessel strike risk reduction done by the author is highly variable based solely on the relationship between ship speed and risk, qualitative in its findings, and speculative.

Redfern *et al.* (2019) compared risk of vessel strike to baleen whales around the Santa Barbara Channel based on 8 years of shipping data (2008-2015). Species evaluated include blue whales, fin whales, and humpback whales using available spatial habitat models and satellite tagging results. Spatial habitat modeling data included the years 1991, 1993, 1996, 2001, 2005, 2008, and 2009. The authors defined collision risk based on the co-occurrence of whales and ships for various management scenarios focused on adding shipping routes, expanding existing area to be avoided, and reducing shipping speed associated with these areas. Encounter rate theory was used to predict relative mortality resulting from vessel strikes by estimating (a) the encounter rate; (b) the number of encounters that result in a collision; and (c) the probability that a collision is lethal (Martin *et al.* 2016, Rockwood *et al.* 2017, Crum *et al.* 2019). The authors concluded that expanding the existing areas to be avoided and speed reductions within shipping lanes and their approaches would be the most effective solutions. Ship speeds declined in the Bight from 2008 to 2015 because California air pollution regulations and economic factors made slow-steaming strategies more favorable, therefore reduction in risk from slowing ships was greatest in 2008 and lowest in 2015.

Rockwood and Jahncke (2019) estimated that humpback whale mortality from January to April in Southern California alone was 6.5 whales (1.63/month), based upon modeling using updated abundance estimates for humpback whales off Southern California. When added to the estimated mortality from July to November, the total estimated annual humpback mortality from vessel strikes in California alone was 23.4 deaths (16.9 + 6.5). This study did not include information for January to April for fin or blue whales and did not estimate humpback mortality in central or Northern California. Thus, even this updated study may underestimate whale mortality. The author's focus was exclusively on shipping approaches to San Francisco Bay (Northern California) and Los Angeles/Long Beach (Southern California) based on Rockwood *et al.* 2017 with new local fine scale analysis. The paper postulated potential mortality from models, not actual reported strikes. The model is used to predict whale mortality based on factors listed in Rockwood *et al.* 2017. In the model results, cargo vessels, especially container ships, accounted for more than half of the predicted mortality for all whale species in both Northern and Southern California with oil tankers accounting for the second highest mortality. The author's recommendation concludes with commercial industry-wide shipping speed reduction recommendations given the model is biased on mortality as a function of speed. In summary, Rockwood and Jahncke (2019) only addresses commercial shipping strike risk associated with major California commercial ports, and therefore, the paper may have limited applicability to how the Navy trains and tests in SOCAL.

Sèbe *et al.* (2019) assesses previous publications on whale vessel strike risk methodology and proposed a systematic approach to addressing the issue called the Formal Safety Assessment: (1) identification of hazards, (2) assessment of risks, (3) risk control options, (4) cost-benefit assessment, and (5) recommendations for decision-making. The authors provided a case study based on data from Rockwood *et al.* (2017). No new data analysis is presented in the paper. Caveats to Sèbe *et al.* (2019) are similar to those mentioned for Rockwood *et al.* (2017, 2019): older marine mammal data that may not be reflective of current or future distribution and focus on limited navigation within shipping approaches by commercial ships means that this study may have somewhat limited applicability to how the Navy trains and tests in SOCAL.

Szesciorka *et al.* (2019) concluded that while whales have some cues to avoid ships, this is true only at close range, under certain oceanographic conditions and if the whale is not otherwise distracted by feeding, breeding, or other behaviors. The paper is based on a single blue whale reaction observed in the Santa Barbara Channel, north of, and outside of, SOCAL. The blue whale was tagged as part of the U.S. Navy-funded Southern California Behavioral Response Study (SOCAL BRS) 2010-2015 and exposed to simulated MFAS when a closest point of approach of 93 m from a passing commercial container ship was noted. The whale was only tagged for a couple of hours before tag detachment. As other published papers report from the SOCAL BRS and as cited in the 2018 HSTT EIS/OEIS, there can be significant individual variation in response to anthropogenic sources, which in this case would include vessel transit.

Blondin *et al.* (2020) estimated blue whale vessel strike risk in the Southern California Bight by combining predicted daily whale distributions with continuous vessel movement data for 4 years (2011, 2013, 2015, 2017). The study focuses on the northern Southern California Bight associated with the commercial vessel traffic separation zone through Santa Barbara Channel approaching the Port of Los Angeles/Long Beach. This area is north of and outside of SOCAL.

The authors found that vessel traffic activity across years (2011, 2013, 2015, 2017) was variable and whale spatial probability was also variable based on inter-annual fluctuations in environmental conditions. Similar to previous monitoring efforts in Southern California, blue whales are typically in higher concentrations north of SOCAL from July-November (Mate *et al.* 2018), and Blondin *et al.* (2020) also picked up on this seasonal variability in their analysis. Oceanographic conditions favorable for krill development and concentration (*i.e.,* cool water periods) would lead to increased blue whale occurrence and higher strike risk as evidenced during the higher number of blue whale strikes in 2007 (Berman-Kowalewski *et al.* 2010). Finally, the coarse level of data analyzed by the authors does not account for short-term patchy prey conditions influencing blue whale occurrence and may result in overestimation of average risk.

Redfern *et al.* (2020) revised their 2019 assessments of vessel strike risk off California using interannual variability of risk across multiple years for blue whale, fin whale and humpback whale. The authors showed higher concentrations of both blue and fin whales along the Central California coast as compared to within SOCAL. Magnitude of vessel strike risk was influenced by the ship traffic scenario. In addition, interannual species variability (1991, 1993, 1996, 2001, 2005, 2008, and 2009) also influenced the magnitude of vessel strike risk, but did not change whether nearshore or offshore scenarios had higher risk. The author's conclusions were similar to Redfern *et al.* (2019). Figure 2 from Redfern *et al.* (2020) illustrates mean blue whale, fin whale, and humpback whale vessel strike risk for California based on data through 2009. Results from more recent NMFS surveys in 2014 and 2018 may or may not change this assessment in the future.

Rockwood *et al.* (2020b) calculated expected blue whale and humpback whale mortality for hypothetical compliance scenarios by imposing speed caps within and adjacent to vessel traffic lanes leading to the Port of San Francisco in Central California, 400 miles (643.7 km) north of SOCAL. Rookwood *et al.* (2020a) had already demonstrated this area off Central California had concentrated krill prey with associated higher distributions of blue whales and humpback whales. Rookwood *et al.* (2020b) used better temporal resolution density data than previous modeling efforts reported by Rookwood *et al.* (2017). Biological data analysis for Rookwood *et al.* (2020b) was based on regional monthly krill and whale surveys from 2004-2017. Rockwood *et al.'* s (2020b) overall modeling conclusions were that lower commercial ship speeds within the vessel traffic lanes could potentially reduce whale mortality from vessel strike. The authors acknowledge that local changes in whale abundance can have strong effects on both inter-annual and long-term patterns of ship-strike mortality.

Bernknopf *et al.* (2021) examined the socioeconomic benefits of using remotely-sensed information instead of in situ observations for determining blue whale occurrence in the eastern North Pacific Ocean. Their analysis used blue whale spatial distribution through 1991-2009 projects as representative of 2017 densities (Becker *et al.* 2012) combined with automatic identification system (AIS) derived measures of civilian commercial vessel traffic to predict blue whale vessel strike risk, called the Reference Case by the authors. The authors then compared estimated blue whale strike risk in a second analysis that, instead of using empirically measured blue whale observations converted into spatial habitat maps, used satellite tracking and environmental data to identify the spatial and temporal distribution of blue whales, called the

Counterfactual Case by the authors (Hazen *et al.* 2017). Estimated mean fatal strikes to blue whales for the Reference Case based on empirical density data from 1991-2009 ranged from 0.0490 to 2.5877 (max. values >1.000 between June to October) (see Table 2 in Bernknopf *et al.* 2021). Estimated mean fatal strikes to blue whales for the Counterfactual Case based on environmental estimates of blue whale density in 2017 ranged from 0.0286 to 2.1556 (max. values >1.000 between August to October). An important caveat to this research is that the two approaches result in different strike risks due to using different blue whale density estimates.

Barkaszi *et al.* (2021) designed a model to estimate risks to large whales from shipping associated with offshore wind development along the U.S. Atlantic Coast. A key caveat for the model is that it is based on civilian vessel types associated with wind energy construction (*e.g.,* tugs, service craft, *etc.*) with relatively fixed, direct routes to offshore wind sites. Therefore, while lower vessel speeds can reduce mortality, prediction and implementation of reduced speed zones are a far more complex challenge (Barkaszi *et al.* 2021). Vessel speed has less effect on strike risk over a fixed distance with fixed target density when there are no behavioral components considered (Yin *et al.* 2019). Vessel speed has a significant effect on strike risk only when behavioral components are considered, thus the ability for the user to input animal or vessel aversion is an important variable that can provide insights to the encounter risk based on vessel speeds.

Cusato (2021) discusses the merits of vessel traffic separation changes or mandatory commercial ship speed reductions in the Santa Barbara Channel to reduce the risk of vessel strikes to large whales. The author compares it to similar restrictions on the U.S. East Coast for North Atlantic right whales. The paper is a policy discussion rather than an analysis of current biological distribution of large whales and associated risk. Cusato (2021) focuses on reducing risk from commercial ships in the current vessel traffic separation scheme within the Santa Barbara Channel. Speed restrictions in the Channel would need to be implemented through either Federal regulations or Federal statute. The author also correctly points out legitimate concerns that operating large vessels at slow speeds in certain conditions could pose a safety risk because large vessels are more difficult to control and steer at slower speeds.

Hausner *et al.* (2021) examined tradeoffs of blue whale vessel strikes and speed reduction mitigation over a 17-year period from 2002 to 2018 in the Southern California Bight under two management scenarios verses a "fixed strategy" that implements speed reductions for a fixed time period each year. The two management strategies were (1) a "daily strategy" implementing speed reductions in response to whale habitat conditions on a daily basis, and (2) a "seasonal strategy" implementing speed reductions in response to whale habitat conditions on a seasonal basis. The period of the author's data analysis also covers the abnormal marine heat wave along the U.S. West Coast (2014-2016). The study's focus was exclusively with the traffic separation lanes leading from the Santa Barbara Channel to the Ports of Los Angeles and Long Beach, a narrow corridor north of and outside of SOCAL. The daily and seasonal management strategies were more effective in reducing blue whale strike risk in the Santa Barbara channel than the fixed strategy. The daily management strategy had the highest protective effect. This apparent difference in strategies also applied during and after the 2014-2016 marine heat wave where the daily strategy added even extra protection. The authors acknowledged that interannual variation on blue whale presence in the shipping lanes added some variability to their analysis. In addition, their study only considered blue whales sighted within the Traffic Separation Scheme, as opposed to the broader region where vessels transit through or a blue whale could occur.

Ransome *et al.* (2021) documented 40 vessel strikes to large whales in the Eastern Tropical Pacific Ocean between 1905 and 2017 off the coasts of 10 Central and South American countries (Mexico to Columbia). The authors concluded that vessel strikes to large whales are more prolific in this region than previously reported. For instance, the author's findings of 40 vessel strikes was over three times greater than previous reporting and still is likely under reporting total whale strikes. The majority of whale strikes occurred from the 1950s onward with the growth of modern shipping and whale watching. Humpback whales were the most commonly struck species (45 percent) although 30 percent of the species were not identified in their data. Rockwood *et al.* (2021), similar to Rockwood *et al.* (2020b), calculated potential whale strike mortalities using AIS vessel data and whale density data to estimate mortality under several management scenarios within the commercial shipping lanes passing through Santa Barbara Channel and San Pedro Channel to and from the Ports of Los Angeles and Long Beach. While the Santa Barbara Channel is approximately 100 miles (160.9 km) north of SOCAL, Rockwood *et al.'* s study area also included the southern vessel traffic approach to Los Angeles and Long Beach which did extend into the northeast coastal portion of SOCAL. Recent whale surveys were not available for this effort, so the authors used long-term average blue, fin, and humpback whale densities from Becker *et al.* (2016). The author's model also predicted a higher level of whale vessel strikes from commercial ships than Rockwood *et al.* (2017), although the authors acknowledged that for the 2020 publication they included more vessel classes than for the 2017 publication.

Silber *et al.* (2021) examined the risk to gray whales from commercial shipping in the North Pacific. Vessel strike risk was highest for gray whales including the Western North Pacific Distinct Population Segment (WNP DPS) along most of the migratory routes. Highest risk to the WNP DPS of gray whales was outside of the SOCAL in the western Bering Sea, along the east coast of the Kamchatka peninsula (Russia), and coastlines of Japan. For both Eastern North Pacific and WNP DPSs of gray whales, the greatest vessel strike risk along the U.S. West Coast was from Washington to Central California.

Helm *et al.* (2023) looked at strike risk to foraging humpback whales surfacing around large cruise ships transiting Glacier Bay National Park, Alaska. The authors concluded that the probability of foraging humpback whales remaining near the surface after first sightings was relatively high. While this puts humpback whales at increased risk of ship strike, it also allows shipboard observers more time to spot whales in order to maneuver the ship to avoid a strike.

Lookout Effectiveness

A recent study by Oedekoven and Thomas (2022) was designed to evaluate the effectiveness of Navy Lookouts at detecting marine mammals before they entered a defined set of mitigation zones (*i.e.,* 200, 500, and 1,000 yd (182.9, 457.2, and 914.4 m)) during MFAS training activities. This study also compared Lookout effectiveness with that of trained marine mammal observers. Lookout teams were comprised of varying numbers of Lookouts depending on the type of ship and the training activity that was occurring (noting that the data was collected prior to the Navy's change in its SOPs to require the use of three Lookouts on Navy cruisers and destroyers.) Marine mammal observer teams consisted of two dedicated observers. Results of this study indicate that Navy Lookout Teams, which include Lookouts and other crew members, have approximately an 80 percent chance of failing to detect a pod of large baleen whales (rorquals) before they come closer than a mitigation range of 200 yd (182.9 m), compared with a 49 percent chance for trained marine mammal observers. The probability of a pod remaining undetected by Lookouts was greater for larger mitigation zones (*i.e.,* 85 percent at 500 yd (457.2 m); 91 percent at 1,000 yd (914.4 m)). These values require some level of interpretation with regard to the numerical results. For instance, the study's statistical model assumed that Navy ships moved in a straight line at a set speed for the duration of the field trials, and that animals could not move in a direction perpendicular to a ship. Violation of this model assumption would underestimate Lookout effectiveness for some data points. The values for both Navy Lookouts and the Marine Mammal Observers include animals under the water that would not have been available for detection by a Lookout. This study suggests that detection of marine mammals is less certain than previously assumed at certain distances.

Hearing, Vocalization, and Masking

A multi-national team of scientists (U.S. and Norway) obtained the first hearing measurements of a mysticete species through auditory evoked potential (AEP) tests. During the 2023 field season, AEP tests were conducted on two adolescent female minke whales in Norway (Houser et al. 2024). Houser et al. (2024) indicate that the minke whale’s upper-frequency limit of hearing occurs somewhere between 45 to 90 kHz. Minke whale’s high-frequency sensitivity is hypothesized to support detection of the echolocation clicks of one their predators, the killer whale. The bandwidth of the tone-bursts used in the Houser et al. (2024) AEP testing was too broad to define the precise upper-frequency limit, but indicates this species is more sensitive to higher frequencies than previously predicted based on inner ear anatomy and vocalization data (Southall et al. 2019; NMFS 2024). Results from their final 2024 field season, which included further examination of the upper-frequency limit of hearing, are expected to be published in 2025, with preliminary data from two additional whales indicating that minke whale hearing is best around 32 kHz.

Parnell *et al.* (2024) studied the soundscapes of four underwater Hawaiian monk seal critical habitats, including measurement of ambient noise and characterization of detected sound sources. The authors observed diel patterns in both anthropogenic and biological sound sources that mask acoustic communication in Hawaiian monk seals. The measurements collected for this study provide a baseline for future research on impacts of anthropogenic activities on these soundscapes.

Branstetter *et al.* (2021) measured underwater, masked hearing thresholds for frequencies between 0.5 and 80 kilohertz (kHz) in two killer whales. Critical ratios computed from the threshold measurements ranged from 16 to 32 decibels (dB). For communication signals in the 1.5-15 kHz range, killer whales would require the signal to be up to 26 dB above background Gaussian noise to be detected. The authors noted that ambient background noise in the marine environment is not Gaussian, the tones used in this study do not contain as much frequency information as biologically relevant signals, and the temporal and spectral characteristics of actual signals and noise may result in some degree of release from masking. These results are consistent with critical ratio measurements from other odontocete species, despite differences in hearing ability and head size.

Fournet *et al.* (2021) measured call amplitudes from male bearded seals in the Beaufort Sea under different ambient noise conditions. The results showed that estimated source levels of seal calls increased with ambient noise up to approximately 100-105 dB root-mean-squared (rms), above which no further Lombard effect was observed. This suggests that masking of bearded seal mating calls may occur, resulting in reduced communication range, which could reduce the ability of bearded seals to detect one another, mate, and reproduce.

Mercado (2021) aimed to characterize how units within humpback whale songs were systematically varied using a large dataset of recordings from off the coast of Kona, Hawaii. The data showed that narrowband, reverberant units repeated at regular time intervals and dominated most song sessions, while broadband units were less predictable and occupied frequency bands that did not overlap with the narrowband units. The persistent production of narrowband units at regular time intervals resulted in consistent reverberation, which could either function to increase the range at which the song can be detected, or listen for fluctuations in echoes to indicate the presence of whale-sized targets.

Rey-Baquero *et al.* (2021) collected theodolite and passive acoustic data on humpback whales in a pristine environment along the Colombian Pacific for 2 months. When acoustic data (n=34 files) were analyzed for unit duration and inter-unit interval before and after boats passed, song unit lengths were shorter and more variable when boats were present. The second aim of this study was to model the whales' communication space during ambient noise or one to two boats traveling slowly. The most common peak frequency of this stock's song (350 Hz) was used in the model, and, along with a whale's location along the coast, informed calculations of transmission loss. However, the source level of "typical whale-watching boats" (145 dB re 1 uPa (decibels referenced to 1 micropascal) at 1 m; (Erbe *et al.* 2012)) and humpback whales (153 dB re 1 uPa at 1 m; (Au *et al.* 2006)) were taken from previous studies. Authors found that the infrequent addition of ecotour boat noise could temporarily reduce the "very audible area" (>10 dB SNR) in their song's commonly used peak frequency (350 Hz) by 63 percent.

Ruscher *et al.* (2021) measured aerial behavioral hearing thresholds in a Hawaiian monk seal (*Neomonachus schauinslandi*). The results showed a hearing range between 0.1 and 33 kHz with relatively poor sensitivity compared to Phocinae seals. The most sensitive thresholds were 40 dB re 20 µPa measured at 800 Hz and 3.2 kHz. The resulting audiogram was most similar to the northern elephant seal, which is the only other species of Monachinae seal with audiogram data (Reichmuth *et al.* 2013). This study suggested that hearing sensitivity of Monachinae seals is substantially reduced compared to other species within their functional hearing group (phocid carnivores in air; PCA); therefore, the use of the PCA weighting function to predict auditory impacts is likely conservative for Hawaiian monk seals.

Sills *et al.* (2021) measured underwater auditory detection thresholds in a male Hawaiian monk seal, and the range of most sensitive hearing was between 0.2 and 33 kHz. Peak hearing sensitivity of 73 dB re 1 µPa was observed at 1.6 kHz. The audiogram for this individual was similar but narrower and elevated compared to the hearing group (phocid carnivores in water; PCW) composite audiogram used to assess impacts to this species. Underwater vocalizations were also measured, and 6 call types were identified, which had peak energy between 55 and 400 Hz. The number of calls produced per minute fluctuated seasonally and peaked in the breeding season with the highest call rates recorded in December.

Sweeney *et al.* (2022) examined the difference between noise impact analyses using unweighted broadband sound pressure levels (SPLs) and analyses using auditory weighting functions. The recordings used to conduct parallel analyses in three marine mammal species groups were from a shipping route in Canada. Since shipping noise was predominantly in the low-frequency spectrum, bowhead whales perceived similar weighted and unweighted SPLs while narwhals and ringed seals experienced lower SPLs when auditory weighting functions were used. The data provide a real-world example to support the use of weighting functions based on hearing sensitivity when estimating audibility and potential impact of vessel noise on marine mammals. A study by von Benda-Beckmann *et al.* (2021) modeled the effect of pulsed and continuous 1-2 kHz active sonar on sperm whale echolocation clicks and found that the presence of upper harmonics in the sonar signal increased masking of clicks produced in the search phase of foraging compared to buzz clicks produced during prey capture. Different levels of sonar caused intermittent to continuous masking (120 to 160 dB re 1 μPa2, respectively , but varied based on click level, whale orientation, and prey target strength. CAS resulted in a greater percentage of time that echolocation clicks were masked compared to PAS.

Kastelein *et al.* (2021c) compared the ability of harbor porpoises to detect signals in constant-amplitude noise with amplitude-modulated noise. Underwater, behavioral hearing thresholds were measured from harbor porpoises at 4 kHz under three conditions: ambient noise (control), sinusoidally amplitude modulated (SAM) masking noise, and Gaussian (constant amplitude) masking noise. Both masker types were centered at 4 kHz with a one-third octave bandwidth and were tested at various SPLs. The SAM noise was also tested at modulation rates from 1-90 hertz (Hz). The 4 kHz hearing test signals were 0.5, 1, and 2 seconds in duration. The results showed that, compared to Gaussian noise, up to 14.5 dB of masking release (from "dip listening") was observed in lower-modulation rate (1-5 Hz) SAM noise. The effect of masking on communication space is often modeled using constant-amplitude noise, whereas most Navy sources contain gaps, more like amplitude-modulated noise. This study suggests that the signal duration, masker level, and masker modulation rate and depth should be considered when modeling the effect of noise on signal detection.

Isojunno *et al.* (2021) used data from 15 tagged sperm whales (Isojunno *et al.* 2020) to evaluate odontocete echolocation behavior as a function of received sonar exposures. Statistical analysis revealed small reductions in the number of buzzes and movement during sonar, but the most apparent change in echolocation behavior was a Lombard effect observed during higher sea states (increased surface noise). No behavioral changes in orientation relative to the sonar source were observed that would suggest an anti-masking strategy for spatial release from masking. Theoretical modeling of masking potential in terms of detection range revealed that search phase clicks would likely be masked during both PAS and CAS, but the buzz clicks would not. For regular search phase clicks to be continuously masked, SELs would have to be equal to or greater than 160 and 173 dB re 1 μPa^2 s (dB referenced to 1 micropascal squared seconds) for PAS and CAS, respectively. Overall, the data showed more evidence for masking by increases in ambient noise (surface noise from higher sea states), than for sonar. This result could be due, in part, to the 1-2 kHz narrowband sonar masker, which is not comparable to broadband maskers such as ambient noise or shipping noise.

Matthews and Parks (2021) reviewed the existing literature on North Atlantic right whale acoustic behavior and summarize information on acoustic behavior of the Southern right whale, North Pacific right whale, and bowhead whale. The authors reviewed primary literature on whale vocalizations, anatomical modeling, and behavioral responses to playbacks to conclude that the North Atlantic right whale might have a hearing range of 20 Hz to 22 kHz. However, vocalization data cannot be used to directly estimate audible range since there are many examples of mammals (including marine mammals) that vocalize with energy below the frequency of best hearing, and calls can also contain high-frequency harmonics that are above the upper limit of hearing. The anatomical model developed by Ketten (1994) was used by Parks *et al.* (2007) to estimate a functional hearing range of 15 Hz to 18 kHz for this species.

Jacobson *et al.* (2022) modeled the probability of Blainville's beaked whale group vocal periods (GVPs) on the Pacific Missile Range Facility during periods of no naval activity, naval activity without hull-mounted MFAS, and naval activity with hull-mounted MFAS. Data were collected from bottom-mounted hydrophones on the range before, during, and after six Submarine Commanders Course (SCC exercises. At an MFAS received level of 150 dB re 1 µPa rms (root mean square), the probability of GVP detection decreased by 77 percent (95 percent CI: 67 percent-84 percent) compared to periods when general training activity was ongoing and by 87 percent (95 percent CI: 81 percent-91 percent) compared to baseline conditions. This study found a greater reduction in p(GVP) with MFAS than observed in a prior study of Blainville's beaked whales at the Atlantic Undersea Test and Evaluation Center (AUTEC) (Moretti *et al.* 2014). The authors suggest that this may be due to the baseline period in the AUTEC study including naval activity without MFAS, potentially lowering the baseline p(GVP), or due to differences in the residency of the populations at each range.

Branstetter and Sills (2022) reviewed direct laboratory (*i.e.,* psychoacoustic) studies of marine mammal hearing in noise. Psychoacoustic studies of auditory masking in marine mammals were described in detail and categorized by the type of signal and masker (*e.g.,* tone in white noise), and specific conditions under which masking is reduced (*i.e.,* release from masking). Specifically, comodulation masking release, or the reduction in masking due to amplitude or frequency modulation differences between the signal and noise, and spatial release from masking, or the reduction in masking due to spatial separation between signal and noise and the directional hearing ability of the listener, are discussed. Finally, energetic masking, or the ability of the listener to detect a signal was compared to informational masking, or the ability of the listener to comprehend the signal was reviewed. The authors point out that while the body of scientific evidence thus far shows that processes of the ear result in energetic masking, more research on informational masking is needed to develop realistic communication space models. This is because current communication space models are based on 50 percent signal detection rather than some threshold of successful signal recognition or interpretation by the listener.

Hearing Loss (TTS and PTS)

Gransier and Kastelein (2024) examined TTS susceptibility in harbor porpoises and harbor seals based on exposures varying in frequency range and level. Specifically, exposures consisted of 100% duty cycle one-sixth-octave noise bands at frequencies covering the entire hearing range of each species. Despite these species having different audiograms and regions of best sensitivity (i.e., underwater pinnipeds are sensitive to sounds ranging from approximately 0.01 to 40-60kHz, while most odontocetes are sensitive sounds ranging from approximately 0.25 to 80–125kHz), the frequency-specific susceptibility to TTS was similar amongst both species, with the greatest susceptibility to TTS occurring at frequencies from 22.5 to 50 kHz and least susceptible to sounds below 10 kHz. The frequency of minimum TTS for the harbor seal aligns with its frequency of best hearing, while frequency of minimum TTS for the harbor porpoise is well below the frequency of best hearing.This study illustrates that the audiogram does not always serve as a good predictor of frequency-dependent susceptibility to TTS, with the pattern of susceptibility to TTS in these two species being more comparable than their audiograms.

Brewer *et al*. (2023) described 41 call types of Cook Inlet beluga vocal behavior and classified them into three categories: 1) whistles, 2) pulsed calls, and 3) combined calls. These are the first descriptions of vocal repertoire of this species in two critical habitat locations and across multiple seasons. Call types were then used to investigate the potential for masking from commercial ships. noise. It was found that call types (0-12 kHz) were partially masked by distant ship noise and completely masked by close ship noise. This study provides evidence that ship noise can impact vocal communication of this population. Specifically Cook Inlet beluga vocalizations in the Susitna area, seven of the beluga's most common calls are either partially or fully masked by commercial ship traffic.

Kastelein *et al.* (2024) examined TTS in two California sea lions exposed to one-sixth-octave noise band centered at 32 kHz for 60-minutes of exposure, resulting in cumulative sound exposure levels (SEL_{cum}) ranging from 168 to 192 dB. Hearing after exposure was examined at the center frequency of the fatiguing sound (32 kHz) and at half an octave (44.8 kHz) and one octave above the center frequency (63 kHz). Higher SEL_{cum} resulted in greater threshold shifts. Furthermore, the greatest TTS occurred at half an octave above the center frequency, with TTS onset (6 dB threshold shift) measured at 44.8 kHz occurring at a 179 dB SEL_{cum}. TTS patterns and recovery was similar between the two individuals, with TTSs up to 6.7 dB recovering within 8 minutes of exposure, TTSs up to 12 dB recovering within an hour, and only the highest TTS measured (12.9 dB) taking over an hour to recover. The results of this study were directly incorporated in the Navy's updated Phase IV AUD INJ/TTS criteria and indicate that California sea lions have lower AUD INJ/TTS onset than previously predicted (Southall et al. 2019).

Houser (2021) reviews existing literature on the relationship between auditory threshold shift and tissue destruction in mammals. According to small terrestrial mammal literature, TTSs of approximately 30-50 dB measured 24 hours after sound exposure induced progressive tissue damage despite the return of normal hearing thresholds. Although large TTSs allow for full recovery of hearing, pathological tissue destruction may occur; however, smaller-magnitude TTSs are unlikely to result in tissue damage. The author concludes that the current criteria of 40 dB of TTS measured within minutes of the noise exposure as the onset of injury is likely to encompass recoverable auditory threshold shift without tissue damage. This publication supports the use of current definitions of auditory injury in marine mammals.

Kastelein *et al.* (2022a) measured underwater behavioral hearing thresholds in two California sea lions at 0.6, 0.85, and 1.2 kHz before and after exposure to a one-sixth-octave noise band centered at 0.6 kHz for 60-minutes. Hearing tests were also conducted at 1, 1.4, and 2 kHz after exposure to a one-sixth-octave noise band centered at 1 kHz for 60-minutes. For the 0.6 kHz exposure, the maximum TTS was 7.5 dB (6.7 dB mean) for a 210 dB cumulative SEL (SEL_{cum}) exposure at the hearing test frequency one-half octave above the center frequency of the fatiguing stimulus (0.85 kHz), which recovered after approximately 12 minutes. For the 1 kHz exposure, the maximum TTS was 10.6 dB (9.6 dB mean) after a 195 dB SEL_{cum} exposure at the hearing test frequency one-half octave above the center frequency of the fatiguing stimulus (1.4 kHz). Mean threshold shift (TS) greater than 6 dB (mean = 8.0 dB, min = 7.2 dB, max = 8.5 dB) was also observed after exposure to the 1 kHz fatiguing stimulus at 195 dB SEL_{cum} for the 1 kHz hearing test frequency. For this exposure frequency, hearing recovered within 24 minutes. The results of this study show individuals exhibiting onset of TTS in water at lower received levels than the otariid thresholds in "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Navy, 2017).

Kastelein *et al.* (2022b) measured underwater behavioral hearing thresholds in two California sea lions at 8, 11.3, and 16kHz before and after exposure to a one-sixth-octave noise band centered at 8 kHz for 60-minutes. Hearing tests were also conducted at 32 kHz after exposure to a one-sixth-octave noise band centered at 16 kHz for 60-minutes. For the 8kHz exposure, the maximum TTS was 20.2 dB (18 dB mean) for a 190 dB SEL_{cum} exposure at the hearing test frequency one-half octave above the center frequency of the fatiguing stimulus (11.3 kHz), which recovered after approximately 12 minutes. For the 16 kHz exposure, the maximum TTS was 19.7 dB (16.3 dB mean) after a 207 dB SEL_{cum} exposure at the hearing test frequency one-half octave above the center frequency of the fatiguing stimulus (22.4 kHz). For these exposure frequencies and scenarios, hearing recovered within 72 minutes or less. The results of this study show TTS onset in-water occurred at lower received levels than what the current otariid criteria in "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III") (Navy, 2017) suggest.

Kastelein *et al.* (2021a) measured underwater behavioral hearing thresholds at 0.5, 0.71, and 1 kHz in one harbor porpoise before and after exposure to one-sixth-octave band noise centered at 0.5 kHz. Maximum TTS was 8.9 dB (mean = 7.6 dB) at the 0.5 kHz hearing test frequency after a 205-dB SEL_{cum} exposure. For the 0.71 and 1 kHz hearing test frequencies, no mean TTS > 6 dB was observed. However, at 0.71 kHz, maximum TTS was 6.5 dB (mean = 5.8 dB) was observed after a 205-dB SEL_{cum} exposure. At 1 kHz, a maximum of 6.3 dB of TTS (mean = 5.7 dB) occurred after 206-dB SEL_{cum} exposures. All shifts < 5 dB recovered within 12 minutes and shifts > 6 dB recovered within 60 minutes. These results are consistent with the criteria and thresholds described in "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Navy, 2017).

Kastelein *et al.* (2021b) measured behavioral, underwater hearing thresholds at 2, 2.8, and 4.2 kHz in two sea lions before and after exposure to band-limited noise centered at 2 kHz. Sea lion hearing was also tested at 4.2, 5.6, 8 kHz before and after exposure to noise centered at 4 kHz. Maximum TTS was 24.1 dB (22.4 dB mean) at the 5.6 kHz test frequency after a 205-dB SEL_{cum}

exposure centered at 4 kHz. Threshold shifts greater than or equal to 6 dB occurred at 187, 181, and 187 dB SEL_{cum} for 4.2, 5.6, and 8 kHz test frequencies respectively. After exposure to the 2-kHz noise, maximum TTS of 11.1 dB (10.5 dB mean) occurred for 203 dB SEL_{cum} at the 2 kHz test frequency. Threshold shifts greater than or equal to 6 dB occurred at SEL_{cum} of 192, 186, and 198 dB for test frequencies 2, 2.8, and 4.2 kHz respectively. These data suggest that one-half octave above the exposure frequency is the most sensitive to noise exposure. TTS between 6 and 10 dB recovered within 60 minutes, 10-15 dB of TTS recovered within 120 min, and TTS up to 24.1 dB recovered after 240 minutes. The results of this study show individuals exhibiting onset of TTS in-water at lower received levels than the current otariid criteria ("Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Navy, 2017)).

Kastelein *et al.* (2020a) measured underwater, behavioral hearing thresholds in one harbor porpoise before and after exposure to playbacks of one-sixth-octave band noise centered at 1.5 kHz and a 6.5 kHz continuous wave. Following exposure to the 1.5 kHz noise band at 201 dB $SEL_{cum,}$ a maximum of a 7.8 dB, 9.8 dB, and 7 dB TTS was observed for 1.5, 2.1, and 3 kHz hearing frequencies respectively. After exposure to the 6.5 kHz continuous wave at 184 dB SEL_{cum}, a maximum of a 7.5, 16.7, and 11.8 dB TTS was observed for 6.5, 9.2, and 13 kHz hearing frequencies respectively. For the 6.5 kHz exposure, a mean TTS > 6 dB was observed for the 178 and 180 dB SEL_{cum} when the hearing test frequency was 9.2 kHz, and for the 180 dB SEL_{cum} when the hearing test frequency was 13 kHz. The results of this study show that the animal incurred onset of TTS at higher received levels than what the current HF cetacean criteria in "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Navy, 2017) indicate for both 1.5 and 6.5 kHz.

Kastelein *et al.* (2020b) measured underwater, behavioral hearing thresholds in two harbor seals before and after exposure to playbacks of one-sixth-octave band noise centered at 0.5, 1, and 2 kHz. Hearing tests were conducted at the center frequency, one-half octave above, and 1 octave above center frequency. No TTS > 6 dB was observed for any hearing frequency after 204, 210, or 211 dB SEL_{cum} exposures to the 0.5 kHz noise band. For the 1 kHz exposure frequency, max TTS of 7.4 dB (6.1 mean) was observed after a 207 dB SEL_{cum} exposure at a hearing frequency of 1.4 kHz. For this exposure frequency, no other test condition produced TTS > 6 dB; although, a 5.9 dB shift (at 1.4 kHz) occurred at 206 dB $SEL_{cum.}$ For the 2 kHz noise band, after a 201 dB SEL_{cum} exposure, max TTS of 12 dB was measured one octave above the center frequency (4 kHz). For this exposure frequency, TTS > 6 dB was observed at SEL_{cum} > 201, 198, and 192 dB for hearing frequencies 2, 2.8, and 4 kHz respectively. All shifts recovered within 1 hour. These results of this study show that the animal incurred lower TTS (*i.e.,* smaller threshold shifts) at higher received levels than what the current phocid pinniped criteria in "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Navy, 2017) indicate.

Kastelein *et al.* (2020c) measured underwater, behavioral hearing thresholds in one harbor porpoise before and after exposure to playbacks of one-sixth-octave band noise centered at 88.4 kHz. Maximum TTS of 13.6 dB was observed at 197 dB SEL_{cum} for the 100 kHz hearing test frequency. No TTS > 6 dB was observed for any SEL_{cum} at the 88.4 kHz test frequency. For 125 kHz, shifts > 6 dB were observed for 191, 194, and 197 dB SEL_{cum} exposures, with a mean TTS of 5.4, 6.1, and 5.9 dB, respectively. The results of this study show that the animal incurred TTS at higher received levels than what the current HF cetacean criteria in "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Navy, 2017) suggest.

Kastelein *et al.* (2020d) measured underwater, behavioral hearing thresholds in one harbor porpoise before and after exposure to airgun impulses ("shots"). Exposure conditions varied with regard to number of airguns, number of shots, light cues, and position of the dolphin relative to the airguns. Hearing test frequencies were 2, 4, and 8 kHz, and no TTS > 6 dB was observed. The results of this study show that the animal would incur TTS onset at higher received levels than what the current HF cetacean criteria in "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Navy, 2017) suggest.

Kastelein *et al.* (2020e) measured underwater, behavioral hearing thresholds in two harbor seals before and after exposure to playbacks of one-sixth-octave band noise centered at 40 kHz. For the 50 kHz hearing test frequency, a maximum TTS of 30.7 dB was observed 12-16 minutes after the 189 dB $SEL_{cum,}$ and a mean TTS > 6 dB was observed for all SEL_{cum} 177 dB and above. The 30-dB shift recovered after 3 days. No TTS > 6 dB was observed for any SEL_{cum} at the 63 kHz test frequency for either seal. At 40 kHz, mean TTS of 9.2 dB was observed after a 189-dB SEL. The results of this study show that the animal incurred TTS at lower received levels than what the current phocid criteria in "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Navy, 2017) suggest.

Sills *et al.* (2020) exposed one bearded seal to multiple impulsive underwater noise exposures (seismic air gun "shots"). Hearing tests were conducted at 100 Hz and 400 Hz after exposures to 2, 4, and 10 shots. After a 4-shot (191 dB SEL_{cum}) exposure, max TTS of 9.4 dB was observed, but no other TTS > 6 dB was demonstrated, despite four 10-shot (194-195 dB SEL_{cum}) exposures. It is possible that TTS recovered during the measurements, as quantified by a mean "first miss" of 7.5 dB for the 10-shot exposures (mean TTS was 2.2 dB). The results of this study show that the animal incurred TTS onset at lower received levels than what the current criteria in "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Navy, 2017) suggest. Behavioral responses were also scored and averaged across three observers. For most exposures, the seal exhibited mild/detectable responses, and all scores indicated that the seal did not move more than half his body and consistently participated in the study.

Tougaard *et al.* (2022) reviewed the most recent temporary TTS data from phocid seals and harbor porpoises and compared empirical data to the predictive exposure functions put forth by Southall *et al.* (2019), which were based on data collected prior to 2015. The authors concluded that more recent data supports the thresholds used for harbor porpoises (categorized as `very high frequency', or VHF cetaceans), which over-estimated the hearing impact for sounds above 20 kHz in frequency. Similarly, the new data for phocid seals show TTS onset thresholds that are well-above the predicted levels for sounds below 5 kHz in frequency. However, phocid seals might be more sensitive to higher frequency sound exposures than predicted, as the TTS onset data for frequencies higher than 20 kHz was below the predicted levels.

von Benda-Beckmann *et al.* (2022) assessed whether correcting for kurtosis, a measure of sound impulsiveness, improved the ability to predict TTS in a marine mammal. Two different kurtosis correction factors were tested by applying them to frequency-weighted sound exposure levels (SEL_{cum}) and fitting (linear least squares) previously collected harbor porpoise TTS data to create dose-response functions, then comparing the resulting R^2 values to that of the standard function used to fit TTS growth data. TTS data from both continuous and intermittent sound exposures were used. For intermittent and continuous 1-2 kHz exposures combined, kurtosis-corrected fits were poorer ($R^2 = 0.47, 0.68$) than SEL_{cum} -based fits ($R^2 = 0.73$). For intermittent exposures of different types, one of the kurtosis-corrections resulted in a better fit ($R^2 = 0.84$) than SEL_{cum} ($R^2 = 0.64$), but only when a model fitting parameter denoting the relationship between SEL_{cum} and risk of permanent hearing loss was specifically derived from harbor porpoise TTS growth data. The conclusions from this study were that the kurtosis-corrected SELs did not explain differences in TTS between intermittent and continuous sound exposures, likely because silent intervals provided an opportunity for hearing recovery that could not be accounted for by these models. Kurtosis might still be useful for evaluating sound exposure criteria for different types of sounds having various degrees of impulsiveness.

Behavioral Reactions

Ceciarini *et al.* (2023) tested the efficacy of Acoustic Deterrent Devices for minimizing common bottlenose dolphin interactions with trammel nets in the Northern Tyrrhenian Sea. The authors used interactive pingers which emitted output signals “from 5 up to 500 kHz at 168 dB re 1 μPa at 1 m as random high-speed tones FM ranging from 100 μs up to seconds”. The study found that catch damage from dolphins was significantly lower in nets where pingers were used.

Elmegaard *et al.* (2023) exposed six harbor porpoises to Acoustic Harassment Devices (AHDs), commonly referred to as “seal scarers”, to determine if they would exhibit any physiological or behavioral reactions. The AHDs pulsed at 14 kHz with a source level of 189 dB re 1 μPa (rms) or sound exposure level of 184 dB re 1 μPa^2s, with porpoise RLs ranging from 98 – 132 dB re 1 μPa. All individuals sampled exhibited a mixture of behavioral or physiological responses, including startling, increased distance from the sound source, increased swim speed, diving, altered echolocation patterns, cardiac responses, or altered respiration patterns. Overall, responses were observed in every individual up to 7 km or down to an RL of 98 dB re 1 μPa.

Frankish *et al.* (2023) followed ten harbor porpoises for 5 to 10 days to observe their reactions to ship traffic around Denmark. The porpoises spent over half of the study period within 10 km of a ship, and a third of the study period exposed to noise levels above ambient. The porpoises responded by moving away from ships during the day, and diving deep during the night. They had a higher likelihood of altering their movements when louder ships were nearby (maximum probability of deterrence = 12.2 percent during the day and 14.9 percent at night), and moved an average of 3.2 km away from 13.6 different ships every day. Deeper dives occurred less frequently, at a rate of 5.7 different ships per individual per night. The porpoises also reacted to loud ships that were far away (>2 km at 93 ± 14 dB re 1 μPa^2), though responses occurred less frequently (5 to 9 percent of the time vs. up to 14.9 percent of the time at close range).

Southall *et al.* (2023) used control exposure experiments (CEEs) to provide the first results in examining the impact of mid-frequency navy sonar (3.5-4.1 kHz) or pseudorandom noise (similar frequency, duration and source and received level compared to mid-frequency sonar) on fin whale behavior in feeding habitats of the Southern California Bight. Of the 15 exposed fin whales, only five individuals demonstrated a mild to moderate behavioral changes (avoidance, changes in feeding, diving, or respiration), with no changes demonstrated for whales in the six control exposures. Compared to blue whales, fin whale behavioral responses were more limited in occurrence, severity and duration and were found to be less dependent upon contextual aspects of exposure, with received level as the primary factor associated with behavioral responses. Additionally, foraging success was not compromised by exposures from this study. The authors note that differences observed between behavioral response in fin whales in this study and blue whales in previously published studies may be attributed to the smaller sample size associated with this study. However, as seen in blue whales, fin whale behavior returned to baseline conditions after noise exposure ended.

In a study by Benti *et al.* (2021), vocalizations from Northeast Atlantic herring-feeding killer whales and Northeast Pacific mammal-eating killer whales were played back to humpback whales in Norwegian waters while their behavior was monitored through animal-borne tags and visual observations. In five of six cases the humpback whales approached the fish-eating killer whales, suggesting some attraction. The response to the mammal-eating killer whales varied with the behavioral context of the humpback whales. The results suggested that the calls of the fish-eating killer whales may have acted like a dinner-bell and initiated approach and foraging behavior in the humpback whales, while the unfamiliar sounds of the mammal-eating killer whales may have been perceived as a threat in offshore waters, but led to mixed behavior during inshore herring foraging by humpback whales. These results indicated that the humpback whales were able to discriminate between the different call types and respond with different behavioral strategies.

Boisseau *et al.* (2021) exposed foraging minke whales in Icelandic waters to an acoustic deterrent device that emitted 15 kHz pure tones with a source level of 198 dB rms. Pulse length and the number of pulses in a block were randomized but average pulse length was 752 millisecond (ms) with a 10 percent duty cycle. The source was deployed from a Zodiac boat 500 m away from an animal for the first two exposures, and 1000 m away in the remaining 8 exposures (max received level of 150 dB RMS at a minimum distance of 338 m). Video-range tracking was used to track animals before, during, and after the exposures and dive duration (sec), swim speed (km/h), reoxygenation rate (blows/min), and path predictability were also examined. During the exposure, animal speed and dive duration increased, measures of path predictability increased indicating straighter paths, and reoxygenation rate decreased. Path predictability had a strong relationship with received level whereas speed and dive duration did not, which suggested those two metrics were more influenced by the presence of the exposure signal than the received sound level.

Curé *et al.* (2021) conducted controlled exposure experiments using both PAS (5 percent duty cycle) and CAS (95 percent duty cycle) to measure and score tagged sperm whale behavioral responses. No sonar control exposures resulted in significantly fewer and less severe behavioral responses than sonar exposures. No significant differences were observed between sonar types, but the presence of killer whales or pilot whales did significantly increase the number of responses. The probability of observing low and medium severity responses increased with cumulative sound exposure level (SEL, dB re 1 µPa2 s), reaching a probability of 0.5 at approximately 173 dB SEL for low severity responses. Medium severity responses reached a probability of approximately 0.35 at cumulative SELs between 179 and 189 dB. This study suggested that both PAS and CAS exposure resulted in a greater number of behavioral changes in sperm whales as compared to the vessel (control) alone, and the types of behavioral responses might differ across sonar types.

Czapanskiy *et al.* (2021) modeled energetic costs associated with behavioral response to MFAS using datasets from 11 cetaceans' feeding rates, prey characteristics, avoidance behavior, and metabolic rates. Authors found that the short-term energetic cost was influenced more by lost foraging opportunities than increased locomotor effort during avoidance. Additionally, the model found that mysticetes incurred more energetic cost than odontocetes, even during mild behavioral responses to sonar.

Durbach *et al.* (2021) analyzed acoustic tracks from minke whales detected on the Pacific Missile Range Facility (PMRF) in Hawaii in 3 years before, during, and after major Navy training exercises. These tracks were fit using a continuous-time correlated random walk at 5-minute interpolated locations. During sonar periods, fast movement became more northerly and more directed (less turning), with less movement south and east in the direction of the training activity, and this more northerly movement continued after sonar cessation. Specifically, whales to the north of the training activity were more likely to head north, while whales that were west of the activity were more likely to head west. Headings did not appear to change for slow, undirected movement during sonar. In addition, fast movement was more likely to occur during sonar than during any other period (70 percent during vs 35-41 percent in the other periods). Finally, whales were more likely to stop calling when in the fast state although not necessarily more during sonar than in other periods; in contrast, slow moving whales were more likely to stop calling during sonar than other periods. These results demonstrated that minke whales moved faster and movements were more directed during periods of active sonar. Minke whales also avoided the locations of the ships producing the sonar and were more likely to cease calling during sonar.

Fernandez-Betelu *et al.* (2021) used passive acoustic data recorded over a 10-year time period to assess the effects of impulsive noise produced during offshore activities on coastal bottlenose dolphin occurrence. Offshore activities included seismic surveys and pile driving from wind farm construction. Echolocation detections of dolphins were compared across years with and without offshore activity and also across days with and without impulsive noise. The effect of distance from the noise-producing activities on dolphin detections was also investigated by placing recorders (CPODs) at locations expected to be the most (impact areas) and least (reference areas) impacted by noise. No consistent relationship was found between annual dolphin occurrence and impulsive noise, but significantly more detections were observed on days with impulsive noise. The results showed that dolphins were not displaced by impulsive noise levels up to 141 dB re 1 μPa and as close as 20 km (10.8 nmi) from the impact area. These results suggest that the increase in dolphin detections during far-field noise was likely due to an increase in the number and/or amplitude of echolocation vocalizations.

Hastie *et al.* (2021) studied how the number and severity of avoidance events may be an outcome of marine mammal cognition and risk assessment. Five captive grey seals were given the option to forage in a high- or low-density prey patch while continuously exposed to silence, pile driving, or tidal turbine playbacks (source levels = 148 dB re 1 μPa at 1 m) for 1 hour. One prey patch was closer to the speaker, so had a higher received level in experimental exposures. Overall, seals avoided both anthropogenic noise playback conditions with higher received levels when the prey density was limited but would forage successfully and for as long as control conditions when the prey density was higher, demonstrating a classic cognitive approach utilized with predation risk and profit balancing.

In a study by Holt *et al.* (2021a), DTAGs (miniature sound and movement recording tags) were attached with suction cups to Southern Resident Killer Whales in the Salish Sea to investigate the relationship between probability of prey capture and vessel and sound variables. The predicted probability of prey capture was lower when vessels increased their speed. Received noise level did not significantly affect the probability of prey capture. The rate of descent during dives was slower when echosounders were on. The observed effects of echosounders suggest that whales prolonged their foraging efforts to successfully hunt, which could be caused by acoustic masking or increased attention to vessels. The rate of descent increased with increasing broadband noise levels and decreasing vessel distance. Decrease prey abundance also decreased the probability of predicted prey capture.

Holt *et al.* (2021b) attached DTAGs to 23 Southern Resident Killer Whales in the San Juan Islands over 3 field seasons in order to investigate the effects of vessel distance on underwater foraging behavior. When vessels were less than 366 m away, whales (n=13) decreased the number of dives associated with prey capture and the amount of time spent in these dives. Additionally, female killer whales were more likely to stop foraging, socializing, and prey-sharing and instead start traveling when vessels approached at this distance. At the same distance from vessels, male orcas were more likely to transition from close prey capture to socializing and prey-sharing, but would not stop general foraging behavior, such as searching for prey at deeper depths. Female orcas may therefore be at greater risk than males during close vessel interactions.

Kates Varghese *et al.* (2021) analyzed the effect of two separate surveys using a 12 kHz multibeam echosounder (*i.e.,* downward directed, unlike ASW sonar) over the Southern California Antisubmarine Warfare Range (SOAR) hydrophone array on Cuvier's beaked whale foraging. The authors conducted a spatial analysis, building off a temporal analysis of a previously presented dataset (Varghese *et al.* 2020). There were differences in spatial use of the SOAR for foraging between the 2 survey years. While no change in overall foraging effort was detected before, during, and after the surveys each year, some localized spatial shifts in foraging hot spots were detected during and after the survey in the second year. Because of the known heterogeneity of prey patches on SOAR, lack of evidence of avoidance of the sound source, and no observed change in overall foraging effort, the authors suggest that the observed spatial shifts were most likely due to prey dynamics.

Königson *et al.* (2021) tested the efficacy of Banana Pingers (300 ms, 59-130 kHz frequency modulated, 133-139 dB rms re 1 μPa at 1 m source level) as a deterrent for harbor porpoise in Sweden. As described previously, these pingers were designed to avoid potential pinniped responses. Authors used recorded echolocation clicks with C-PODs to measure the presence or

absence of porpoise in the area. Porpoise were less likely to be detected at 0 m and within 100 m of an active pinger, but a pinger at 400 m appeared to have no effect.
In a study by Laborie *et al.* (2021), unmanned aerial vehicles (UAVs) were flown at three altitudes (25, 20, and 15 m) over Weddell seals, including adult males and females and females with pups. There was generally little response; 88 percent of the time the animals showed mild vigilance or no responses, and mothers rarely ended nursing. Agitation or escape responses only occurred in 12 percent of observations. The strongest response was in females with pups when wind speeds were lowest and therefore ambient noise levels were at their lowest. The probability of response increased with lower altitude flights, so at altitudes over 25 m a low level of impact to Weddell seal behavior would be expected.

Manzano-Roth *et al.* (2022) found that cross seamount beaked whales reduced clusters of foraging pulses (Group Vocal Periods) during Submarine Command Course events and remained low for a minimum of 3 days after the MFA sonar activity.
An analysis subsequent to Varghese *et al.* (2020) suggested that the observed spatial shifts of Cuvier's beaked whales during multibeam echosounder activity on the Southern California Antisubmarine Warfare Range were most likely due to prey dynamics (Kates Varghese *et al.* 2021).

Ramesh *et al.* (2021) explored environmental drivers and the impact of shipping noise on fin whale vocalizations in Ireland. Approximately 3 months of passive acoustic fin whale call data from spring 2016 used in the habitat model found that fin whale calls increased at night, along with signs of higher prey availability. Fin whale calls were also less likely to be detected for every 1 dB re 1 μPa/minute increase in shipping noise levels (rms). However, these results should be used cautiously since the model was more likely to predict the absence of fin whale detections, rather than their presence.

Santos-Carvallo *et al.* (2021) monitored fin whale behavior before, during, and after the presence of whale watching vessels in Caleta Chañaral de Aceituno to determine if the whale watching activity was having any adverse impacts on the fin whales. Whale watching activities were only conducted by local artisanal fishers; 39 boats have permission but less than 20 conduct the whale watching activity. Land-based observations were conducted in January and February of 2015-2018 via binocular scans and focal follow tracking using a theodolite. Groups of whales were tracked through the area with continuous sampling of position, behavior, and presence of boats for every surfacing until they were no longer visible. Behavior was classified as traveling or resting, and the groups' swim speed, reorientation, and directness index, and these were modeled relative to the number of boats and whether the time period was before, during, or after the boats were present. Most observations occurred within the presence of at least one boat, but no more than three boats at one time. Travel swim speeds increased in the after period, while reorientation increased and directness decreased during and after the presence of boats. During rest behavior, reorientation increased during the presence of boats compared to before the boats were present, and directness decreased during the presence of boats. These results indicate that when whale watching vessels were present, the fin whales changed their direction of movement more frequently, with less linear movement than occurred before the boats arrived; this behavior may represent evasion or avoidance of the boats. The increase in travel swim speeds after the boats left the area may be related to the vessel's rapid speeds when leaving, sometimes in front of animals, leading to more avoidance behavior after the boats departed.

Arranz *et al.* (2021) conducted a noise exposure experiment which compared behavioral reactions of resting short-finned pilot whale mother-calf pairs during controlled approaches by a tour boat with two electric (136-140 dB) or petrol engines (139-150 dB). Approach speed (<4 kn (7.4 km per hour)), distance of passes (60 m (65.6 yd)), and vessel features other than engine noise remained the same between the two experimental conditions. Behavioral data was collected via unmanned aerial vehicle (UAV) and activity budgets were calculated from continuous focal follows. Mother pilot whales rested less, and calves nursed less, in response to both types of boat engines compared to control conditions (vessel >300 m (328 yd), stationary in neutral). However, they found no significant impact on whale behaviors when the boat approached with the quieter electric engine, while resting behavior decreased 29 percent and nursing decreased 81 percent when the louder petrol engine was installed in the same vessel.

Hiley *et al.* (2021) exposed groups of harbor porpoises to “startle sounds”, which were 200-ms in duration and were band limited (5.5-20.5 kHz) with a peak frequency of 10.5 kHz and a source level of 176 dB re 1 µPa. There were 13 exposure sequences in which the startle sound was repeated for 15 minutes at a 0.6 percent duty cycle, and 11 control sequences in which vessels operated but no startle sounds were played. Despite a larger distance between porpoise groups and vessels during sound exposure trials (152 m) as compared to control trials (90 m), avoidance responses during exposures were significant whereas no avoidance was observed for controls. Porpoises avoided the area where sound exposures took place for approximately 30-60 minutes, and no long-term exclusion effect was observed.

Pellegrini *et al.* (2021) examined how boat presence impacts a unique subspecies of bottlenose dolphin (*Tursiops truncatus gephyreus,* Lahille's bottlenose) that vocalizes while foraging cooperatively with local fishermen who cast nets onto dolphin-herded fish while standing in coastal waters in Brazil. Dolphin vocalizations changed in response to the number, type, and speed of boats within 250 m. When more than one boat was present, dolphins produced fewer whistles and had a lower click rate and a longer whistle duration; initial and maximum frequency increased as well, especially when group size or calf presence increased. Whistles were longer duration when boat speed increased as well.

Martin *et al.* (2022) exposed a wild Cape fur seal breeding colony in Africa to playback recordings of boat noise and sea-side car traffic. Focal groups of at least six seals were approached by an experimenter who crawled within 6 m to avoid disturbing the seals. Seals were exposed to low (60-64 dB re 20 µPa rms SPL, broadcast at 6 m), medium (64-70 dB, broadcast at 3 m), or high (70-80 dB, broadcast at 1 m) levels, depending on the individual's distance to the speaker. No behavioral differences were found between low, medium, and high-level groups. Video recorded behavioral analysis demonstrated that mother-pup pairs spent less time nursing (15-31 percent) and more time awake (13-26 percent), vigilant (7-31 percent), and mobile (2-4 percent) during boat noise conditions compared to control conditions. Mothers were more vigilant (26 percent) than pups (7 percent) to medium levels of boat noise.

Jones-Todd *et al.* (2021) analyzed the movement of seven Blainville's beaked whales tagged at (AUTEC) relative to MFAS use during the SCC training event. Data from these tags was previously reported by Joyce *et al.* (2019). A continuous time correlated random walk movement model accounted for location accuracy by modeling 100 track imputations for each tag and arranged samples in equal time intervals. The probability of whale presence within the boundary of the instrumented range (on range), and outside the boundary of the instrumented range (off range) was modeled relative to the time since the last MFAS transmission. Results show there was a higher probability that whales on the range would go off range when there were MFAS transmissions, and that whales off the range would stay off the range when there were MFAS transmissions. These results indicate a response to MFAS that lasted for 3 days since transition rates on-off and off-on the range returned to baseline levels after that amount of time. There was also variability in transition rates and time spent on/off range between individuals, which highlights the need to analyze a larger sample size of whales.

Durban *et al.* (2022) tested new methods of observing behavioral responses of groups of small delphinids to sonar, where the use of tags is challenging, and the response of the group is more salient than that of the individual. They tested the use of a land-based observation platform coupled with a drone and multiple acoustic recorders to observe the vocal behavior, group cohesion, group size, and group behavior before, during, and after a simulated sonar exposure. In a group of short-beaked common dolphins, the authors found the number of whistles and sub-groups to increase during the exposure period, but the directivity of the tracked subgroup did not change much.

Königson *et al.* (2022) tested the efficacy of Banana Pingers (300 ms, 59-130 kHz frequency modulated, 133-139 dB_{rms} re 1 µPa at 1 m source level) as a deterrent for harbor porpoise in Sweden. As described previously, these pingers were designed to avoid potential pinniped responses. Authors used recorded echolocation clicks with C-PODs to measure the presence or absence of porpoise in the area. Porpoise were less likely to be detected at 0 m and within 100 m of an active pinger, but a pinger 400 m appeared to have no effect.

Miller *et al.* (2022) investigated the risk disturbance hypothesis that an animal's response decision is a trade-off between perceived risk and the cost of a missed opportunity (the reward of foraging). The authors predicted that species that are more vulnerable to predation would be more likely to respond to both predator sounds and anthropogenic stressors. Using data collected from 2008 to 2017 during the 3S project in Norway, changes in foraging duration during killer whale playbacks and changes in foraging duration during mid-frequency sonar were positively correlated across the four species examined (listed in order of increasing sensitivity to foraging disruption: sperm whales, long-finned pilot whales, humpback whales, and northern bottlenose whales). This suggests that tolerance of predation risk may play a role in sensitivity to sonar disturbance.

Paitach *et al.* (2022) tested the efficacy of Banana Pingers (300 ms, 50-120 kHz frequency modulated, 145 dB +/− 3 dB at 1 m source level) as a deterrent and entanglement mitigation for Franciscana dolphins in Brazil. These pingers were designed to emit sound outside of the best hearing range for pinnipeds and were therefore less likely to incite a “dinner bell” effect. Authors used recorded echolocation clicks with C-PODs to measure the presence or absence of dolphins in the area. Dolphins were 19 percent and 15 percent less likely to be detected nearby and within 100 m of an active pinger respectively, but dolphins 400 m from the pinger did not appear to avoid it. While a reduction in vocalizations does not always equate to a reduction in presence, this species has been previously seen departing from areas with active pingers. Authors did not witness any habituation to the pinger during the length of the experiment (64 days), and although they recorded fewer dolphins in the area over time, they believe this was due to seasonality rather than habitat displacement.

Siegal *et al.* (2022) used Dtag data from 15 northern bottlenose whales tagged during 3S efforts off Norway (2013-2016) to estimate body density (to represent body condition by lipid energy stores) using hydrodynamic models and obtain foraging and anti-predator indicators based on vocal behavior and dive metrics. The authors compared relative anti-predator/foraging indices to body condition and found that relative anti-predator to foraging indices typically did not depend on body condition. This finding is inconsistent with the needs/assets hypothesis; an individual in poor condition would accept more risk (*i.e.,* engage in less anti-predator behavior) for foraging opportunities, whereas healthy animals can afford to be more risk averse (*i.e.,* have a relatively higher anti-predator to foraging index ratio). The authors suggest that this result may be due to an insufficient range of body conditions in the data set to determine a relationship, or a selection of bolder individuals in the tagging effort. The authors also suggest that animals in good condition may take greater predation risks because they may successfully flee. Three of the 15 whales were exposed to sonar (presented in prior 3S publications). The authors compared foraging and anti-predator metrics pre- and post-exposure, showing that all three animals increased their anti-predator index and reduced their foraging index.

Stanistreet *et al.* (2022) used passive acoustic recordings during a multinational navy activity to assess marine mammal acoustic presence and behavioral response to especially long bouts of sonar lasting up to 13 consecutive hours, occurring repeatedly over 8 days (median and maximum SPL = 120 dB and 164 dB). Cuvier's beaked whales and sperm whales substantially reduced how often they produced clicks during sonar, indicating a decrease or cessation in foraging behavior. Few previous studies have shown sustained changes in foraging or displacement of sperm whales, but there was an absence of sperm whale clicks for 6 consecutive days of sonar activity. Sperm whales returned to baseline levels of clicks within days after the activity, but beaked whale detection rates remained low even 7 days after the exercise. In addition, there were no detections from a Mesoplodon beaked whale species within the area during and at least 7 days after the sonar activity. Clicks from northern bottlenose whales and Sowerby's beaked whales were also detected but were not frequent enough at the recording site used to compare clicks between baseline and sonar conditions.

Benhemma-Le Gall *et al.* (2021) compared harbor porpoise presence and foraging activity between periods of baseline and construction at two Scottish offshore windfarms with arrays of echolocation click detectors (C-PODs). Noise levels were measured with calibrated noise recorders, and vessel presence was tracked with AIS data. Authors found an 8-17 percent decline in porpoise presence compared to baseline, with more porpoises (more buzzing) further from vessels, construction sites, and related higher levels of noise. The probability of porpoise occurrence by source vessels decreased by 9-23 percent without piling activity, and by 40-54 percent during pile driving. Porpoises were displaced up to 12 km (6.5 nmi) from pile driving and 4 km (2.2 nmi) from construction vessels. At an average vessel distance of 2 km (1.1 nmi), porpoise occurrence decreased by up to 35 percent. Outside piling hours, porpoise detection decreased by 17 percent (0.26), and foraging (buzzes) decreased by up to 41.5 percent (0.03) with increasing noise levels (159 and 155 dB re 1 μPa, respectively). During piling activities, porpoise occurrence began lower (0.16, 102 dB) but occurrence still decreased by 9 percent (0.07), and foraging (buzzes, beginning at 0.76, 104 dB) also decreased by 61.8 percent (0.15) with increasing noise levels (161 and 155 dB re 1 μPa, respectively).

Kastelein *et al.* (2022c) recorded pile driving sounds 100 m from construction for an offshore windfarm turbine, and six versions of the sound were created with varying frequency content using low-pass filters at 44.1, 6.3, 3.2, 1.5, 1.0, and 0.5 kHz, at levels of 135 dB re 1 μPa^2 s. When authors played these impulsive sounds back to a single harbor porpoise in a pool, she increased swim speed, respiration rate, distance from the transducer, and occasionally jumped in response to the sounds with higher frequencies present (*i.e.,* the sounds with a wider bandwidth, especially sounds low-pass filtered at 44.1 and 6.3 kHz). However, the porpoise still moved away from the three most narrowband sounds, just not as far. Results indicate that frequency weighting of SEL may improve prediction of harbor porpoise behavioral responses, and authors present the argument that weighted SELs should be used for reporting behavioral response threshold levels for criteria.

Todd *et al.* (2022) detected harbor porpoises with C-PODS before, during, and after pile driving for an oil and gas platform from 2015-2020. Pile driving single strike SEL at 750 m was 160-164 dB re 1 μPa^2 s. Porpoise detections significantly decreased at the beginning of the construction project, but detections appeared to return to baseline levels within 5 months. According to the authors, the lack of significant trend over years indicated that porpoises returned to the area and did not experience habitat displacement for the entire 5-year period.

Physiological Responses and Stress

Elmegaard *et al.* (2021) exposed two captive harbor porpoises to sonar sweeps (6-9 kHz, 500 msec duration, 50-100 msec rise time, varying received levels (RL)) and pulsed sounds (50 msec duration, peak frequency 40 kHz, half power bandwidth of ~5 kHz, rise time < 5 msec, varying RL) to investigate startle reflex and changes in heart rate. The sonar exposures did not elicit startle responses; the initial two to three exposures induced bradycardia (a slow heart rate), with subsequent habituation. This habituation was conserved after a 3-year pause in exposures. The authors suggest that the initial bradycardia allows "a prolonged breath-hold to assess the nature of a novel stimuli or flee in crypsis if needed;" in naïve wild cetaceans, the reduced peripheral perfusion caused by this response may reduce N_2 diffusion from supersaturated tissues during dive ascents, increasing risk of decompression sickness. Startle responses to the pulse exposures were directly correlated to RL. The 50 percent motor-startle probability threshold was around 130 dB re 1 μPa (rms50). This is ~85 dB above hearing threshold and is similar to that observed in bottlenose dolphins (~90 dB over hearing threshold) (Gotz *et al.* 2020). No significant change in heart rate was observed. The authors suggest that the parasympathetic cardiac dive response may override any transient sympathetic response, or that diving mammals may not have the cardiac startle response seen in terrestrial mammals in order to maintain volitional cardiovascular control at depth.

Fahlman *et al.* (2021) reviews decompression theory and the mechanisms dolphins have evolved to prevent high N2 levels and gas emboli (*i.e.,* bends-like symptoms) in normal conditions. However, in times of high stress, the selective gas exchange hypothesis states that this mechanism can break down. In addition, circulating microparticles may be useful biomarkers for decompression stress in cetaceans.

Yang *et al.* (2021) measured cortisol concentrations in blood samples of two captive bottlenose dolphins and found significantly higher levels after exposure to high sound level (140 dB re 1 μPa) impulsive noise playbacks, compared to control and low sound levels (0 and 120 dB re 1 μPa, respectively . Six cytokine gene transcriptions were also measured in blood samples and two (IL-10 and IFN-γ) showed significant changes at high sound level exposure, compared to control and low sound levels. Results suggest that repeated exposures or sustained stress response to impulsive sounds may increase an affected individual's susceptibility to pathogens, affect growth and reproduction, *etc.* In addition, no avoidance behavior was observed during the trials, indicating that stress-induced physiological changes could be present despite the absence of behavioral changes.

Williams *et al.* (2022) measured physiological and behavioral responses in narwhals in the Arctic during seismic airgun impulse exposure compared to control conditions. Responses were measured using heart rate-accelerometer-depth recorders and changes in locomotor, cardiovascular, and respiratory responses were observed following exposure. Airgun SELs, as received at 10 m depth during sound source verifications, were approximately 152 dB re 1 μPa^2 s at 1 km (0.5 nmi) range and decreased to approximately 120 dB re 1 μPa^2 s at 10 km (5.4 nmi) dives. The response to seismic and vessel noise was a reduction in gliding descents and prolonged periods of high intensity activity associated with periods of elevated stroke frequencies. Noise exposure also resulted in periods of prolonged and intense bradycardia (*i.e.,* slowed heart rate). An increase in post-dive respiratory rates occurred during recovery from noise-exposed dives compared to control dives.

Stranding

Danil *et al.* (2021) document the findings of NOAA's investigation of the strandings of three coastal bottlenose dolphins in 2015 at Silver Strand Training Complex in NOAA Technical Memorandum NMFS-SWFSC-641. On October 21, 2015, two dolphins were found stranded dead near each other on the beach. Because a Navy major training exercise (MTE) was underway, these strandings met the criteria of an Uncommon Stranding Event in accordance with the Southern California Stranding Response Plan in the Navy's Phase 2 LOA for HSTT. A third decomposed dolphin was found in the same area 10 days later. Examination of the dolphins resulted in findings indicative of severe acute trauma, including lower jaw subcutaneous hemorrhage, emphysema, and cervical blubber hemorrhage. Additional signs of injury to the cerebrum and heart, or lipids in the lungs were also discovered. No hemorrhage was found near the ears. At least two of the dolphins showed signs of feeding before stranding, and all were in robust condition. There were no external signs of strike or entanglement. These observations and lack of others did not clearly determine the cause of the acute trauma. Based on previous case studies, the investigators determined that underwater detonation, peracute underwater entrapment (*i.e.,* fisheries interaction), or sonar were the most plausible causes. The Navy notes that sonar has not been associated with these kinds of symptoms before, nor has there ever been any association between dolphin mortality and sonar. No anti-submarine (ASW) sonar or explosive use was associated with the Navy MTE; however, unit level training with MF1 sonar occurred on October 19 (for 35 minutes) and October 20 (62 minutes in total), with sonar use as close as 6 nmi (11.1 km) to the stranding location. No known squid or bait fishing efforts within U.S. waters occurred in the vicinity preceding the strandings. The Navy notes that it is unknown what fishing efforts occurred in Mexican territorial waters immediately south of the stranding location. Wang *et al.* (2021) conducted an auditory-evoked potential (AEP) hearing test on a single stranded 19-year-old male melon-headed whale in the 9.5—181 kHz frequency range. Tone pip trains were presented underwater at a depth of 0.3 m and 1 m distance from the whale, and AEPs were recorded by suction cup electrodes on the skin surface. Hearing was measured in this individual after it had been stranded and during attempted rehabilitation in a concrete pool. Eighteen frequencies were measured once, and eight frequencies were measured twice, yielding an audiogram that showed elevated hearing thresholds (compared to the pygmy killer whale) between 10 and 100 kHz. There are no data from normal-hearing individuals of the melon-headed whale species to which this study's data can be compared.

Methodology for Assessing Acoustic Impacts

Indeck et al. (2024) assessed North Atlantic right whale, fin, and blue whale detectability by Slocum gliders near heavily used shipping lanes in the Gulf of St. Lawrence, Canada. The goal of the study was to evaluate the gliders' suitability as a passive acoustic monitoring (PAM) platform for whale detection in areas with high anthropogenic noise levels. The authors found that shipping lane noise did not substantially impact whale detectability, as calls from the highly trafficked areas were not masked significantly more than calls in quieter areas nearby. The gliders were therefore identified as a viable PAM platform to use in and around busy shipping areas. These results suggest that gliders could be an important tool for monitoring mysticetes in highly industrialized areas and assisting in ongoing dynamic management initiatives.

Population Consequences of Disturbance and Cumulative Stressors

Southall *et al.* (2021) provided updated guidance and methods to assess the severity of behavioral responses by marine mammals to several types of anthropogenic noise sources. The criteria developed in the 2007 effort were updated by explicitly distinguishing between captive and field studies, decoupling their respective severity scales, and splitting the severity scale into three categories of foraging, survival, and reproduction. In addition, the updated guidance changed the categorization of noise sources and began to consider long term consequences of exposures rather than just immediate responses. Additional and consistent metrics to be reported in behavioral response studies are recommended, including subject-specific metrics (*e.g.,* functional hearing group, age class, sex, behavioral state, presence of calf), exposure context metrics (*e.g.,* exposure type, range to source, source and animal depth, presence of other species or other noise sources), and noise exposure metrics (*e.g.* exposure duration, rise time, number of exposures, SPL [rms and p-p], SEL, SNR). The authors then applied the severity scale to acute exposure studies using sonar sources, continuous (industrial) sources, pile driving sources, and airgun sources. For the long-term exposure analysis, a set of factors developed by Bejder and Samuels (2003) were applied to long-term studies on whale-watching and other long-term exposure or multi-exposure datasets. These factors included metrics of short-term impacts and long-term survival measures, characteristics of the studies, and sources of anthropogenic disturbance. The applied examples of scoring both acute and long-term studies of behavioral response provide a framework for other researchers to apply the same metrics to their own studies.

Migrating humpback whale mother-calf pairs' responses to seismic surveys were modeled by Dunlop *et al.* (2021) using both a forwards and backward approach. While a typical forwards approach can determine if a stressor would have population-level consequences, authors demonstrated that working backwards through a population consequences of disturbance (PCoD) model can be used to assess the “worst case” scenario for an interaction of a target species and stressor. Assumptions for the extreme scenario were likely exaggerated (*e.g.,* in area for > 48 hours, exposed to > 3 air gun events) but lack data to inform humpback nursing behavior and calf survivability during acoustic stressors. The results demonstrated that migrating whales would not likely experience enough of a delay as a result of disturbance to result in population consequences, but whales disturbed in breeding or resting areas would be more vulnerable to consequences of disturbance.

Greenfield *et al.* (2020) demonstrated that bottlenose dolphins who had been injured from boat strike or entanglement experienced a decline in their social network's preferred associations, and as a result were more vulnerable to predation and less fecund.

Hin *et al.* (2021) used a previously published energy budget model for pilot whales (Hin *et al.* 2019) to examine how lost foraging days affect individuals in a population at carrying capacity. In this model, depletion of prey is dependent on whale density, and prey density limits the energy available for growth, reproduction, and survival. The authors assumed extreme disturbance events for this study: consecutive days of no foraging affecting all individuals in a population. The undisturbed whale population was regulated through the effect of prey availability on calf survival and pregnancy rates and on age at first reproduction of females. During a disturbance event, population decline was generally attributed to loss of lactating females and calves due to reduced body condition. The subsequent increase in prey density and per capita prey availability, however, resulted in improved body condition in the population overall and decreased age at first calf. As disturbance duration was increased (~40 days of no foraging), the population would enter extreme decline towards extinction.

Murray *et al.* (2021) conducted a cumulative effects assessment on Northern and Southern Resident killer whales, which involved both a Pathways of Effects conceptual model and a Population Viability Analysis quantitative simulation model. Authors found that both populations were highly sensitive to prey abundance and were also impacted by the interaction of low prey abundance with vessel strike, vessel noise, and polychlorinated biphenyls contaminants. However, more research is needed to validate the mechanisms of vessel disturbance and environmental contaminants.

Pirotta *et al.* (2020) reformulated their previous dynamic energy budget model (Pirotta *et al.* 2018) to investigate the state-dependent life history strategies of female long-finned pilot whales and trade-offs between their body condition (*i.e.,* ability to offset starvation during pregnancy and provide milk), prey availability, and decision to reproduce in situations with and without disturbance. Many whales in this model attempted to reproduce young, and while that had no cost in situations without disturbance, young mothers would starve and die when foraging was prevented by some disturbance event or because resources were low (winter). Whale reproductive strategies resulted in lower lifetime reproductive output, compared to the model used in Hin *et al.* (2019).

Pirotta *et al.* (2021) integrated different sources of data (*e.g.,* controlled exposure data, activity monitoring, telemetry tracking, and prey sampling) into a bioenergetic model, which was used to predict effects from sonar on a blue whale's daily energy intake. Approximately half of the simulated whales had no change in daily net energy intake because they either had no response or were not exposed. However, the other half experienced a decrease in net energy intake. A portion (11 percent) of those simulated whales had negative net energy even after brief (*e.g.,* 6-30 min) or weak (*e.g.,* 160-180 dB re 1 μPa source level) events, which indicated that they would not be able to cover that day's energetic cost. This dichotomy in results was due to the variation in activity budgets, lunging rates and ranging patterns between tagged whales. This evidence suggests that context can influence the predicted costs of disturbance even more than body size or prey density distribution on a daily scale (although prey availability and abundance affected behavioral patterns).

Pirotta *et al.* (2022) evaluated potential long-term effects of changing environmental conditions and military sonar by modeling vital rates of Eastern North Pacific blue whales. Previous work from Pirotta *et al.* (2021) was used as a foundation for incorporating the most recent best available science into the vital rate model presented in this study. Using data and underlying models of behavioral patterns, energy budgets, body condition, contextual responses to noise, and prey resources, the model predicted female vital rates including survival (age at death), and reproductive success (number of female calves). The model simulation results showed that "[e]nvironmental changes were predicted to severely affect vital rates, while the current regime of sonar activities was not." The case study used an annual sonar regime in SOCAL based on the description of the action in the Navy's 2018 HSTT EIS/OEIS. Additional military sonar scenarios were modeled, and a ten-fold increase in sonar activity combined with a shift in geographical location to overlap with main feeding areas of blue whales resulted in a moderate decrease in lifetime reproductive success (Cohen's d = 0.47). However, there was no effect on survival (Cohen's d = 0.05).

Pirotta (2022) covered the development of bioenergetic models ["any mechanistic model where the principles of metabolic ecology are used to describe how an individual animal acquires energy from food resources (*i.e.,* energy intake) and allocates assimilated energy to various life history functions (*i.e.,* energy costs, including maintenance and survival, growth and reproduction)"] with a focus on applications to marine mammals. This article provided a thorough overview of the history of marine mammal bioenergetic models, defined relevant terminology, and explained the differences between general types of models.

McHuron *et al.* (2021) developed a state-dependent behavioral and life history model to predict the probability of Western gray whale mother-calf pair survival with and without acoustic disturbance and with or without adequate prey availability on their summer foraging grounds.

Pregnant mother movement, feeding behavior, fat mass and fetal length were input data for the model. Since prey availability was co-dependent on whales having access to high-density offshore areas by mid-July, nearshore seismic surveys had no impact on population fecundity or mother-calf survival. This model overcomes a key challenge in PCoD literature by providing a link between behavioral responses and vital rates; authors recommend focusing on species that are data rich to accurately characterize the biology of the focal species, metrics of fitness, and key qualities of their environment.

Joy *et al.* (2022) presented a hypothetical case study for fin whales off Southern California exposed to stationary single-ship 53C sonar events over the course of a year, using the Navy's Phase 3 behavioral response function (BRF . Two model runs were compared: using $\alpha = 0.05$ (average 20-minute movement disruption) and α 0.99 (average 3 days movement disruption). When animals returned to baseline behavior after a short disturbance ($\alpha = 0.05$), there was less regional displacement and thus more instances of behavioral disturbance over the course of a year. When animals returned to baseline behavior after a longer period (α 0.99), there were fewer instances of behavioral disturbances over the course of a year due to cumulative displacement from habitat near the sonar source.

Keen *et al.* (2021) reviewed 15+ years of PCoD modeling and identified the most critical factors for determining long-term impacts to populations. Critical factors include life-history traits, disturbance source characteristics, and environmental conditions. No specific model or quantitative assessment was proposed.

Methodology for Assessing Acoustic Impacts

Palmer *et al.* (2022) recorded North Atlantic right whale upcalls using 10 Marine Autonomous Recording Units deployed in Cape Cod Bay from February to May 2009. A modified equation was provided for determining the effective survey area, including a Lombard coefficient, for single sensor applications. The authors state manual annotation or verification is nearly always used to confirm automated detector outputs prior to near-real-time conservation measures due to limitations in automatic detector capabilities.

Aircraft Noise

Kuehne *et al.* (2020) measured in-air and underwater sound from low-altitude EA-18G Growler flights in the immediate vicinity of Ault Field at Naval Air Station Whidbey Island (NASWI). Data were collected by two in-air recorders and one hydrophone placed just off the runway at a depth of 30 meters. The underwater 10-flight average sound measurement was 134 ± 3 dB re 1 μPa rms in the highest 1-second window. The results showed that the peak frequency range of the Growler overflight noise both in air and underwater was between 50 and 1,000 Hz, which is typically a frequency range with high background noise underwater, particularly in areas with large amounts of vessel traffic (Erbe *et al.* 2012). The study did not include behavioral observations of wildlife, and the authors' conclusions about potential impacts to wildlife were unsupported by data from the study. In a separate effort, Kuehne and Olden (2020) relied on volunteers to identify military aircraft noise in recordings taken on land on the Olympic Peninsula. This study also did not examine impacts to or responses by wildlife to aircraft.

We reiterate that NMFS reviewed the Navy's analysis and conclusions that aircraft noise will not result in incidental take of marine mammals, and finds the analysis and conclusions complete and supportable, as stated in the 2018 HSTT final rule. Please see section 3.7 (Marine Mammals) of the 2018 HSTT EIS/OEIS for additional information.

Having considered this information, in combination with new information considered in NMFS' 2020 SIR, none of these new references present significant new circumstances or information within the context of the requirements established by the CEQ regulations because their conclusions and findings do not change the analysis of impacts to marine mammals and their habitat or conclusions in the 2018 HSTT EIS/OEIS. NMFS and the Navy have reviewed this information and concur that the new information published or otherwise conveyed since the 2018 HSTT EIS/OEIS was published would not fundamentally change the assessment of impacts or conclusions in the 2018 HSTT EIS/OEIS or in NMFS' MMPA rulemaking. Nonetheless, the new information and data were thoroughly reviewed. The information and data relevant to acoustic criteria and thresholds was not available in a timeframe in which NMFS could have incorporated it into the quantitative analysis supporting this analysis; however, NMFS did consider the information qualitatively. While these changes in the auditory injury thresholds and weighting functions could result in minor increases in PTS exposure estimates for some species, given the conservative assumptions built into the take estimate methodology, they would not be expected to result in meaningful, if any, changes in take estimates and would not be expected to change any of the conclusions. NMFS and the Navy will continue to monitor and review new information and evaluate if and how that information applies to the NMFS' or the Navy's assessment of marine mammals and marine resources.

Vessel Strikes

Since 2021 there have been five strikes of large whales in SOCAL attributed to naval vessels, three by the U.S. Navy and two by the Royal Australian Navy. The U.S. Navy struck a large whale in waters off Southern California in May 2023. Based on available photos and video, NMFS and the Navy have determined this whale was either a fin whale or sei whale. The U.S. Navy struck two unidentified large whales during the months of June and July 2021, and prior to that, on May 7, 2021, the Royal Australian Navy HMAS Sydney, a 147.5 m (161.3 yd) Hobart Class Destroyer, struck and killed two fin whales (a mother and her calf) while operating within SOCAL. In the case of the Royal Australian Navy strike, the carcasses were first sighted under the bow of the vessel while it was approaching the Naval Base in San Diego. The whales had been pinned to a sonar dome in the front of the vessel due to the force of water as the ship was underway. Based on interviews with HMAS Sydney personnel, the most likely time of impact with the two whales would have been around 6:25 AM when the vessel was located near Cortes Bank, and visibility was poor. The reported vessel speed at the estimated time of strike was 9 kn (16.7 km per hour). One minute before the estimated strike time a lookout reported whales off the starboard bow. The officer on-watch verbally acknowledged the report, slowed speed, and visually tracked the whales passing clear down the starboard side until they were clear of the ship. The morning of the strike, the HMAS Sydney was getting into position to participate in a U.S. Navy-led exercise later that day. Of note, throughout the remainder of the day visibility was poor and the vessel had implemented mitigation measures in multiple instances due to whale occurrence. In addition to being the only documented occurrence of a foreign military vessel strike of a large whale within the HSTT Study Area, the HMAS Sydney vessel strike was also somewhat unique, as compared to other reported military vessel strikes, in that two whales were apparently struck at one time, and both remained pinned to the front of the vessel until the vessel approached the port.

On June 29, 2021, a U.S. Navy cruiser struck an unknown whale species approximately 95 nmi (176 km) west of San Diego. The ship was returning from Hawaii, heading to a rendezvous with a fuel replenishment vessel (oiler) for an Underway Replenishment. Off-duty sailors noticed a group of whales approaching the ship from the port quarter (*i.e.*, left rear of the ship), an area unique to cruisers with some equipment structures blocking close aboard sight. The first indication of a whale within the 500-yd mitigation zone immediately prior to the strike was when an off-duty sailor on the flight deck witnessed the whale briefly surface on the aft port quarter before diving. Shortly after this occurred blood was noticed in the wake, and a floating whale body was eventually observed behind the ship. The ship's speed was 25 kn (46.3 km per hour) at the estimated time the strike occurred. The Navy also noted that, on the morning before the strike occurred, the ship had maneuvered several times to avoid whale blows beyond the 500-yd (457.2 m) mitigation zone, closer to 1,000 yd (914.4 m).

On July 11, 2021, a U.S. Navy cruiser struck an unknown whale species approximately 90 nmi (166.7 km) south-southwest of San Diego. The vessel was a participant in a MTE (Large Integrated Anti-Submarine Warfare - Composite Unit Training Exercise) within the SOCAL portion of the action area. The vessel was maneuvering for pending flight operations to receive an inbound helicopter. At 2:27 p.m., the starboard lookout sighted what they believed to be a whale crossing immediately under the vessel's bow. The conning officer attempted to maneuver the vessel by turning to port but internal watchstanders subsequently felt the ship shudder aft. The vessel's combat center observed a red slick 600 yd (548.6 m) astern on a flight deck camera and a brief surfacing of the whale itself, but no carcass was observed. There had not been any sightings of large whales off the bow leading up to the incident. Although the ship was traveling at 25-30 kn (46.3-55.6 km per hour) 1 hour before the estimated strike time, at 10 minutes before, the vessel changed course and reduced its speed to 17 kn (31.5 km per hour). These 2021 incidents were the first known U.S. Navy vessel strikes in the HSTT Study Area since 2009.

On May 20, 2023, a U.S. Navy aircraft carrier was at sea conducting independent, unit-level flight training for the embarked airwing approximately 70 nmi (129.6 km) west of San Diego. Training exercises concluded for the day at approximately 7:44 p.m. local time. Navy personnel discovered a whale impinged on the bow of the vessel at approximately 8:00 p.m. local time. The vessel was traveling at approximately 5 kn (9.3 km per hour) and had recently made a turn to reset position for the evening when the Navy personnel discovered the whale. Navy personnel captured video and photos of the carcass, and based on those images, NMFS and the Navy have determined this whale was either a fin whale or sei whale; the two species are very similar morphologically and are difficult to distinguish from one another at sea. Navy personnel stopped the vessel to allow lack of momentum to dislodge the carcass from the bow, and based on lack of further observations after the carcass dislodged, it is believed to have sunk around 9:30 p.m. local time. Navy personnel on board the vessel reported that they did not feel an impact from striking the whale. Prior to the strike, between 6:45 p.m. and 7:45 p.m., the forward Lookouts on the vessel observed two whales crossing the vessel's bow but did not provide a distance between the vessel and the whales. One Lookout reported seeing the blow and the other reported seeing ‘humps’ (presumably the dorsal of the animal). Both whales were sighted past the ship’s course to the northwest. Within the same time window, one of the aft Lookouts observed a single whale swimming parallel to the ship and soon passed astern of the ship. During the same time, independent of the sightings and for general movement reasons, the ship changed speed from 17 kn (31.5 km per hour) to 10 kn (18.5 km per hour) at 7:22 p.m.

While in this incident a whale was discovered impinged on the bow of a Navy vessel, this incident is very different from the discovery of two fin whales discovered impinged on the sonar dome of a Royal Australian Navy vessel in 2021 when the vessel came to port at Naval Base San Diego. While U.S. Navy cannot speculate on the configurations of other ships bows and even sonar dome specifications (that may be at the bow), the Navy believes it would be implausible for a marine mammal to become lodged on the sonar dome of a U.S. Navy ship and remain undetected due to a technological standard operating procedure. Sonar domes on U.S. Navy ships have a pressurized rubber window that maintains 150 pound-force per square inch (PSI) through the ship’s fire main. If anything affects the pressure, an alarm sounds in the sonar control room. In the event of a whale strike in that location, this alarm would alert personnel that something hit the sonar dome. Further, the shape, hydrodynamic design, construction using a non-abrasive material, and regular hull cleaning procedures to remove barnacles and other growth on U.S. Navy ships also make it unlikely that a whale would become lodged and remain undetected on a U.S. Navy ship’s bow or even sonar dome. While in the case of the May 2023 strike, described above, a whale also became lodged on the ship’s bow, the aircraft carrier that struck the whale does not have active or passive sonar capabilities (*i.e.*, no sonar dome), nor does it have a bulbous bow, and the whale was more quickly discovered by Navy personnel.

In March 2024 a dead fin whale was discovered off of Pier 10 in Naval Station San Diego within the Navy’s security barrier. The security barrier, which consists of a series of connected floating sections, is intended to discourage unauthorized boat entry to the piers. The necropsy indicated that vessel strike was the most likely cause of death. Given the location the whale was discovered, this could have been the result of a military vessel strike. However, the Navy reviewed its vessel activity during that time frame and available observations of those vessels coming and going to port, as well as at port, and determined it was unlikely that the whale was carried into port by a Navy vessel. Based on this and other information from Navy’s investigation, we cannot determine whether this whale was struck by a Navy vessel during HSTT activities or was struck by a commercial or other vessel and drifted into the Navy pier area.

Public Comments

On June 1, 2022 (87 FR 33113), NMFS published a notice of receipt (NOR) of the Navy’s application in the *Federal Register*, requesting comments and information related to the Navy’s request for a modification of the 2020 HSTT final rule and LOAs to authorize two additional takes of large whales by serious injury or mortality by vessel strike. On October 3, 2023 NMFS published a notice of the proposed rulemaking (88 FR 68290) to solicit relevant environmental information and provide the public an opportunity to submit comments on the proposed extension and NMFS’ analysis and determinations.

In the 2023 HSTT proposed rule, we indicated that the Navy and NMFS as a cooperating agency had made a preliminary determination that each of the proposed rules and any subsequent LOAs would not result in significant impacts that were not fully considered in the 2018 HSTT EIS/OEIS. We stated in the proposed rule that, as indicated, the Navy had made no substantial changes to the activities nor were there significant new circumstances or information relevant to environmental concerns or their impacts. We indicated that NMFS would make a final NEPA determination prior to a decision whether to issue a final rule.

During the public comment period for the 2023 proposed rule, NMFS received comments from a non-governmental organization and private citizens. NMFS considered all public comments received in response to the publication of the NOR and the proposed rule and used these comments to inform the analysis under the MMPA and to develop mitigation, monitoring, and other conditions for the 2023 HSTT final rule and LOAs. NMFS' responses to specific comments can be found in the final rule available for review on NMFS' website (*https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-military-readiness-activities*).Of note, one public comment suggested that NMFS and the Navy must supplement the EIS prior to issuing a new final rule. Please see NMFS' final rule for additional information.

Authorization of Two Additional Takes by Serious Injury or Mortality by Vessel Strike

Take by serious injury or mortality by vessel strike proposed for authorization in the proposed rule (88 FR 68290; October 3, 2023) is included in Table 4. As noted in that table, NMFS is authorizing additional take by serious injury or mortality by vessel strike of the CA/OR/WA stock of fin whale, Eastern North Pacific stock of gray whale, Mainland Mexico-CA/OR/WA stock of humpback whale, and Eastern North Pacific stock of sei whale. The final rule includes a full analysis of these additional impacts and the MMPA determination that the authorized take will have a negligible impact on each species and stock. As described in Section 3.1 of this SIR, NMFS determined that the proposal to modify the MMPA regulations and issue new LOAs (effective from publication date of the final rule through December 20, 2025) to the Navy authorizing two additional takes by serious injury or mortality by vessel strike would not result in substantial changes in the proposed action described and evaluated in the 2018 HSTT EIS/OEIS that are relevant to environmental concerns.

3.3 Other Regulatory Processes

Endangered Species Act: There are sea turtle, fish, and marine mammal species under NMFS jurisdiction listed as endangered or threatened under the ESA with confirmed or possible occurrence in the HSTT Study Area. The marine mammal species include the blue whale, fin whale, gray whale, humpback whale, sei whale, sperm whale, false killer whale, Hawaiian monk seal, and Guadalupe fur seal. ESA-designated critical habitat for Hawaiian monk seals and Main Hawaiian Islands Insular false killer whales is also located in the HSTT Study Area. Section 7(a)(2) of the ESA requires federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in adverse modification or destruction of their designated critical habitat. Where there are likely to be adverse effects to listed species caused by a Federal agency's action, the agency must engage in formal consultation with NMFS. The Navy's action (*i.e.*, training and testing activities in HSTT study area) and NMFS' Permits and Conservation Division action (*i.e.*, issuance of MMPA regulations and LOAs) are federal actions likely to cause adverse effects to listed species and were thus subject to the formal consultation requirements of section 7 of the ESA. As a result, during the development of the 2018 HSTT EIS/OEIS, the Navy consulted formally with the NMFS Interagency Cooperation Division pursuant to section 7 of the ESA for its training and testing activities in the HSTT Study Area. NMFS' Permits and Conservation Division also consulted internally, with the NMFS Interagency Cooperation Division, pursuant to section 7 of the ESA for issuance of the 2018 HSTT MMPA regulations and LOAs under section 101(a)(5)(A) of the MMPA.

On December 10, 2018, the NMFS Interagency Cooperation Division issued a Biological Opinion that considered the effects of both the Navy and NMFS Permits and Conservation Division proposed actions. In this opinion, the NMFS Interagency Cooperation Division concluded that neither the Navy's proposed training and testing nor the issuance of the 2018 HSTT MMPA regulations and subsequent LOAs were likely to jeopardize the continued existence of the threatened and endangered species[10] or result in the destruction or adverse modification of critical habitat in the HSTT Study Area. The December, 2018 Biological Opinion also included an Incidental Take Statement (ITS) exempting incidental take of listed species, including marine mammals, that was reasonably certain to occur as a consequence of both actions (*i.e.*, Navy conducting training and testing activities and NMFS Permits and Conservation Division's issuance of MMPA regulations and LOAs). The ITS included requirements for reasonable and prudent measures and implementing terms and conditions designed to minimize incidental take of listed species. In addition, the December, 2018 Biological Opinion included the conditions under which either the Navy or NMFS Permits and Conservation Division would be required to reinitiate formal Section 7 consultation. These conditions are known as "reinitiation triggers" and consist of the following:

1) The amount or extent of taking specified in the ITS is exceeded.
2) New information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered.
3) The identified action is subsequently modified in a manner that causes an effect to ESA listed species or designated critical habitat that was not considered in the opinion.
4) A new species is listed, or critical habitat designated under the ESA that may be affected by the action.

For issuance of the 2020 HSTT final rule, NMFS concluded that no reinitiation triggers have been met, and therefore, reinitiation of consultation under section 7 of the ESA was not warranted. However, to ensure the ITS associated with the December, 2018 Biological Opinion is consistent with NMFS Office of Protected Resources Permits and Conservation Division consideration to issue revised MMPA regulations and new LOAs under the seven-year rule (effectively, a two-year extension of the existing five-year 2018 HSTT MMPA regulations), the NMFS Office of Protected Resources Interagency Cooperation Division amended the ITS to cover the seven-year period. This includes clarifying the exempted number of lethal and non-lethal takes is covered for the seven-year period; the only increase in the number of takes was lethal takes for listed sea turtles, which were projected using the same effects analysis used in Section 9.2 of the December, 2018 Biological Opinion. The December, 2018 Biological Opinion and the associated ITS for this action are available at

[10] For species under NMFS jurisdiction.

https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-military-readiness-activities.

In 2021, NMFS determined that new information regarding vessel strike of large whales met reinitiation trigger 2 (formal consultation should be reinitiated if “new information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered”). Given new information regarding the recent occurrence of large whale strikes by naval vessels in the southern California portion of the HSTT Study Area, the Navy reinitiated consultation with NMFS pursuant to section 7 of the ESA for HSTT Study Area activities, and NMFS also reinitiated consultation internally on the issuance of these revised regulations and LOAs under section 101(a)(5)(A) of the MMPA. (Note that, unlike the the 2018 HSTT EIS/OEIS, the 2018 Biological Opinion and ITS, as well as the 2020 amended ITS, predicted specific numbers of take by mortality by vessel strike.)

NMFS issued a reinitiated Biological and Conference Opinion on June 3, 2024 concluding that the issuance of a modified HSTT final rule and subsequent LOAs are not likely to jeopardize the continued existence of the threatened and endangered species under NMFS' jurisdiction and are not likely to result in the destruction or adverse modification of critical habitat in the HSTT Study Area. The opinion is available at https://doi.org/10.25923/7y9x-vw84.

National Marine Sanctuaries Act: NMFS’ issuance of MMPA regulations and LOAs is a federal action subject to consultation requirements under section 304(d) of the NMSA. There are two national marine sanctuaries in the HSTT Study Area, the Hawaiian Islands Humpback Whale National Marine Sanctuary and the Channel Islands National Marine Sanctuary.

<u>Hawaiian Islands Humpback Whale National Marine Sanctuary:</u> The military activities the Navy proposes to conduct in the Sanctuary fall into classes of activities covered in the 1997 FEIS/Management Plan for the Sanctuary, which under the Sanctuary regulations do not require permits or further consultation under section 304(d) unless the military activity is modified in a manner significantly greater than was considered in a previous consultation. These military activities are also the same classes of activities previously analyzed in the Navy's 2013 HSTT Final EIS/OEIS and for which ONMS found no further consultation was required in a letter dated August 16, 2013. The activities have not been modified in a manner significantly greater than those considered in the 2013 HSTT Final EIS/OEIS and, therefore, further consultation by the Navy was not required. NMFS is not proposing to authorize additional take of marine mammals by vessel strike of large whales in Hawaii.

<u>Channel Islands National Marine Sanctuary:</u> Proposed military activities in the Sanctuary are consistent with those activities described in the sanctuary's regulations and in Section 3.5.9 (Department of Defense Activities, preexisting activities) of the 2009 EIS/Management Plan. The Navy's proposed activities are not significantly modified in such a way that possible adverse effects on Sanctuary resources or qualities are significantly different in manner than previously considered. The training and testing activities currently proposed are also the same classes of activities previously analyzed in the Navy's 2013 HSTT Final EIS/OEIS and for which the ONMS found no further consultation was required in the letter dated August 16, 2013. The activities have not been modified in a manner significantly greater than those considered in the 2013 HSTT Final EIS/OEIS; therefore, further consultation by the Navy is not required.

NMFS has likewise determined that it is not required to consult further under section 304(d) of the NMSA on its action of reviewing and processing the Navy's request for incidental take authorization. For both the Hawaiian Islands Humpback Whale NMS and the Channel Islands NMS, NMFS is evaluating the same Navy military activities in the same proximity to the sanctuaries for which it has been determined that further consultation by the Navy under section 304(d) is not required. The only change is that the modified regulations and LOAs would authorize two additional takes by large whales by serious injury or mortality of stocks that occur in the Southern California portion of the HSTT Study Area and would include several new and revised mitigation measures in addition to continuing all other reasonable and prudent mitigation measures from the 2020 HSTT final rule, such that further consultation would be unlikely to provide additional protections for sanctuary resources.

In modifying the HSTT regulations and LOAs to authorize two additional takes of large whales by serious injury or mortality by vessel strike, no greater injury, destruction, or loss and no new injury, destruction, or loss is likely to occur from an action that was not previously considered. In addition, no new action is proposed that is likely to destroy, cause the loss of, or injure a sanctuary resource, including the two additional takes of large whales by serious injury or mortality, as these takes would not be expected to occur within Sanctuary boundaries. The effects of the Navy's activities on sanctuary resources, including marine mammals, were analyzed in the 2018 HSTT EIS/OEIS beyond five years and into the reasonably foreseeable future. NMFS' 2023 HSTT proposed MMPA rule analyzes the effects of and would authorize incidental take two additional large whales by serious injury or mortality. Given everything discussed above, there are no changes that meaningfully or substantially deviate from the analysis and findings that would require further consultation. Thus, NMFS has determined that it is not required to consult further under section 304(d) of the NMSA on its action of reviewing and processing the Navy's request to authorize two additional takes of large whales by serious injury or mortality by vessel strike.

4.0 Public Review and Participation

NMFS determined, through the explanations within this SIR, that the new information and circumstances are not significant and that there are no substantial changes to NMFS' proposed action. In addition, the public had two opportunities to comment on the modified regulations during the MMPA authorization process. NMFS published a notice of receipt of the Navy's application in the Federal Register on June 1, 2022 (87 FR 33113) and provided a 30-day comment period on the application. NMFS also published a proposed rule in the *Federal Register* on October 3, 2023 (88 FR 68290), with a 45-day comment period. In that proposed rule, we indicated we believed it was appropriate to rely on the 2018 HSTT EIS/OEIS in assessing impacts to the human environment, including impacts to marine mammals associated with NMFS' issuance of modified MMPA regulations and LOAs and requested that interested persons submit relevant information, suggestions, and comments. During the 45-day comment period, we received 20 comment submissions. Of this total, one submission was from a non-governmental organization (NGO) and the remainder were from private citizens. The comments received focused on estimated take, mitigation and monitoring measures, NMFS' determinations, and NEPA.

The two NEPA comments included one that stated that none of the alternatives considered in detail an alternative that would require mandatory speed limits to avoid collisions with endangered whales. As described in NMFS' full response to this comment, the Navy conducted an operational analysis of potential mitigation throughout the entire Study Area to consider a wide range of mitigation options, including but not limited to vessel speed restrictions, and why vessel speed restrictions beyond what is identified in Chapter 5 (Mitigation) of the 2018 HSTT EIS/OEIS would be impracticable to implement. A commenter also recommended that NMFS prepare a supplemental EIS given new information that has come to light since 2018, including on the impacts of vessel strikes on large whales and on alternatives that reduce vessel strike impacts to marine mammals. NMFS disagrees with the commenter that supplemental NEPA evaluation is warranted. As described in the National Environmental Policy Act section herein, in accordance with 40 CFR 1502.9 and the information and analysis contained in this rule, the Navy and NMFS as a cooperating agency have determined that this final rule and any subsequent LOAs would not result in significant impacts that were not fully considered in the 2018 HSTT EIS/OEIS. As indicated in this final rule, the Navy has made no substantial changes to the activities nor are there significant new circumstances or information relevant to environmental concerns or their impacts. Additional public review and opportunity to comment is not warranted. A more detailed summary of comments and NMFS' responses to those comments will be included in the MMPA final rule, which will be available at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-military-readiness-activities.*

5.0 Decision and Conclusion

Based on the information presented herein, NMFS has determined there is no need to supplement the 2018 HSTT EIS/OEIS in order to grant the Navy's request to revise the 2020 MMPA regulations and LOAs, by effectively authorizing two additional takes by serious injury or mortality for the following reasons:

- There are no substantial changes to the proposed action (NMFS' or the Navy's) relevant to environmental concerns,
- The new circumstances and information relevant to environmental concerns and bearing on the proposed action (NMFS' or the Navy's) or its impacts are not significant under NEPA, and
- Granting the request to effectively authorize two additional takes by serious injury or mortality and the new information and circumstances identified in Section 3.2 will not result in impacts beyond those considered in 2018 HSTT EIS/OEIS.

Therefore, the 2018 HSTT EIS/OEIS remains valid and NMFS will continue to rely on it to support NMFS' proposed action, which is issuance of modified MMPA regulations and LOAs to the Navy. However, NMFS has prepared a new ROD for this proposed action.

Approved by: RAUCH.SAMUEL.DEAN.1365850948 Digitally signed by RAUCH.SAMUEL.DEAN.1365850948 Date: 2024.12.26 09:09:32 -05'00' Date: ____________

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