



"The Navy has undertaken many efforts in the past decade to help preserve, protect, and restore the beautiful, diverse environment in the Pacific Northwest where our Sailors live and work. We are committed to working alongside our community partners including the Tribes, NGOs, and local governments to carry on these efforts so everyone can continue to cherish this region's land and waterways for generations to come."

Rear Admiral Brad J. Collins
Commander, Navy Region Northwest

ENVIRONMENTAL STEWARDSHIP



Navy Region Northwest: 2010 – 2019
October 2021

Cover: Scientists conducting a beach seine survey of fish species in Kilisut Harbor. The Navy partnered with other federal, state, county, tribal, and non-governmental organizations to replace an earthen causeway between Indian Island and neighboring Marrowstone Island with a bridge. This restoration action reconnects Oak Bay to Kilisut Harbor, opening up 2,300 acres of protected habitat in the Puget Sound to marine species, including juvenile salmonids. Photo by U.S. Navy.



Navy Region Northwest Environmental Stewardship

Fiscal Year 2010 to Fiscal Year 2019

October 2021

This page is intentionally blank.

FOREWORD

This report was compiled at the recommendation of the Assistant Secretary of the Navy (Energy, Installations, and Environment) to enhance communications in environmental planning and stewardship associated with implementation of Secretary of the Navy Instruction (SECNAVINST) 5090.8B, Policy for Environmental Protection, Natural Resources, and Cultural Resources Programs.

The purpose of the document is to summarize information on Navy efforts and expenditures on ecosystem studies, management, and restoration in the Pacific Northwest over a recent 10 years period. The data were compiled to document the Navy's overall level of commitment to execute the national defense mission in a manner compatible with restoring and protecting the quality of the environment for current and future generations.

The report shows that about 65 million dollars were invested by the Navy over the 10 year period to integrate environmental protection with Navy operations and activities. All Navy commands in the Northwest can use this information when communicating with federal, state, and local agencies, Native American tribes, and the public.

This document may be accessed on the Navy Region Northwest website:

<https://www.cnic.navy.mil/regions/cnrnw.html>

Contact information is provided below for assistance or to offer comments or feedback. Navy commands in the Northwest are encouraged to share environmental investment information for future updates, which are planned for publication every two years.

Navy Region Northwest Environmental Program Director (NRNW/N45)

Environmental Planning and Natural Resources Division

Email address: PAO_feedback@navy.mil

A handwritten signature in black ink, appearing to read 'B. J. Collins', with a stylized flourish at the end.

B. J. COLLINS
Rear Admiral, U.S. Navy
Commander, Navy Region Northwest

This page is intentionally blank.

Table of Contents

Table of Contents	v
Acronyms	vii
1. Introduction	1
1.1 Two Mutually Supportive Mission Dimensions	2
1.2 Need for Data to Support Resource Management and Regulatory Compliance.....	2
2. Natural Resource Projects and Expenditures, FY 2010 to FY 2019	5
2.1 Summary of Expenditures and Trends by Natural Resource Project Category	5
2.2 Discussion of Expenditures and Trends, FY 2010 to FY 2019.....	5
3. Natural Resource Project Examples	11
3.1 Marine Mammal Surveys and Monitoring.....	11
3.2 Fish Surveys, Aquatic Habitat Assessments, and Fish Management.....	13
3.3 Avian Surveys and Monitoring	16
3.4 Other Species Surveys.....	17
3.5 Habitat Improvement and Restoration	19
3.6 Forest and Vegetation Management.....	22
3.7 Compensatory Mitigation for Loss of Aquatic Resources	23
3.8 Tribal Treaty Mitigation.....	24
4. Text References	27
Appendix A: Natural Resource Projects, Navy Region Northwest, FY 2010 to FY 2019.....	A-1
Appendix B: Natural Resource Reports, Navy Region Northwest, FY 2010 to FY 2019	B-1

Tables

Table 2-1. Expenditures (\$) by Natural Resource Project Category, FY 2010 to FY 2019	7
Table 3-1. Salmonids observed in the nearshore environment by WDFW at NRNW installations during multiple years of survey effort, between 2012 and 2017.	13

Figures

Figure 1. Navy Northwest Region total annual expenditures on natural resource projects, FY 2010 to FY 2019	6
Figure 2. Harbor seal mother and pup. Photo by D. Steckler under NMFS permit 15569.....	11
Figure 3. Adult male California sea lion with newly applied satellite tag hauled out on the Port Security Barrier at Naval Base Kitsap Bremerton. Photo by NMFS.....	12
Figure 4. Rockfish observed by WDFW's Remotely Operated Vehicle (ROV) in the Naval Base Kitsap Bangor's nearshore environment. Photo by Dayv Lowry.	14
Figure 5. Salish sucker caught by WDFW. Photo by WDFW.....	15
Figure 6. WDFW's primary sampling units and strata in the Puget Sound for marbled murrelet in-water surveys. (Pearson and Lance, 2018).....	16
Figure 7. American pika observed at NRS(T) Jim Creek. Photo by WDFW.....	17
Figure 8. Washington Ground Squirrels. Photo by Jodie Delavan, USFWS.....	18
Figure 9. Arch culvert installed over Beaver Creek, looking north toward Little Clam Bay, 2019. Photo by U.S. Navy.	19
Figure 10. Cutthroat trout juvenile observed in Beaver Creek during USFWS 2019 surveys. Photo by U.S. Fish and Wildlife Service.	19
Figure 11. Section of Maylor's Point bluff before (left) and after (right) hard shoreline was removed in 2018. Photos by Northwest Straits Foundation.	21

Figure 12. Canopy cover (above) and large woody debris (below) at a Navy installation forest plot. Photos by U.S. Navy.....	22
Figure 13. Cattail Lake (above) in 2011 prior to removal of the artificial impoundment and Cattail Estuary (below) in 2019 six years after the restoration action. Photos by U.S. Navy.....	23
Figure 14. Navy volunteer during the 2019 clam seeding event (above) and clam seeds scattered on the beaches of Naval Magazine Indian Island (below). Photos by U.S. Navy.	24
Figure 15. Local citizens of Marrowstone Island, Navy Region Northwest Sailors, state and federal government officials, and members from numerous groups around the Puget Sound and Olympic region participated in a groundbreaking ceremony for the Kilisut Harbor Restoration Project. U.S. Navy photo by Mass Communication Specialist 2nd Class Wyatt L. Anthony/Released.....	25

Acronyms

AEP	auditory evoked potential
BA	Biological Assessment
BGEPA	Bald and Golden Eagle Protection Act
CNIC	Commander, Naval Installation Command
CNRNW	Commander, Navy Region Northwest
CWA	Clean Water Act
DBRC	Dabob Bay Range Complex
DoD	United States Department of Defense
EHW2	Explosive Handling Wharf No. 2
ESA	Endangered Species Act
EXWCNAVFA	Engineering and Expeditionary Warfare Center
FY	fiscal year
HCCC	Hood Canal Coordinating Council
IHA	Incidental Harassment Authorization
INRMP	Integrated Natural Resources Management Plan
IWFMP	Integrated Wildland Fire Management Plan
LOA	Letter of Authorization

M3R	multifunctional, mobile and modular radar
MBTA	Migratory Bird Treaty Act
MILCON	Military Construction
MMPA	Marine Mammal Protection Act
NAS	Naval Air Station
NAVBASE	Naval Base
NAVFAC NW	Naval Facilities Engineering Systems Command Northwest
NAVSEA	Naval Sea Systems Command
NAVSTA	Naval Station
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service (NOAA Fisheries)
NOAA	National Oceanographic and Atmospheric Administration
NRNW	Navy Region Northwest
NRS(T)	Naval Radio Station (Transmitter)
NUWC	Naval Undersea Warfare Center
PACFLT	United States Pacific Fleet
POM	Program Objective Memorandum
PSRF	Puget Sound Restoration Fund
REPI	Readiness and Environmental Protection Integration
SECNAVINST	Secretary of the Navy Instruction
SERDP	Strategic Environmental Research and Development Program
SRKW	Southern Resident killer whales
U.S.	United States
USFWS	United States Fish and Wildlife Service
USNVC	United States National Vegetation Classification
WDFW	Washington Department of Fish and Wildlife
WFMP	Wildland Fire Management Plan

Navy Region Northwest Environmental Stewardship

Fiscal Year 2010 to Fiscal Year 2019

This report summarizes natural resource management projects and associated expenditures in Navy Region Northwest (NRNW) from Fiscal Year (FY) 2010 to FY 2019.

1. Introduction

Commander, Navy Region Northwest (CNRNW) manages 79,328 acres onshore, or about 124 square miles, in 11 states: Alaska, Washington, Oregon, Idaho, Montana, Wyoming, North Dakota, South Dakota, Nebraska, Minnesota, and Iowa. These lands include seven major installations, 16 Navy Operational Support Centers, and 79 other sites with over 200 supported commands and over 48,000 military and civilian employees and contractors.

Additionally, the United States (U.S.) Pacific Fleet (PACFLT) conducts training activities and Naval Sea Systems Command (NAVSEA) conducts testing activities around the world, including in the Pacific Northwest and Alaskan marine environments. In conducting those activities, the Navy's goal is to protect the unique and sensitive resources present in areas where it trains and conducts tests, while still providing the realistic experiences necessary for the readiness and safety of personnel.

The Navy invests in scientific research, collects data, applies the most current science and latest technologies in environmental analyses, and implements environmental stewardship programs.

Because of its geographic breadth, the land managed by CNRNW encompasses a rich variety of ecosystems including arctic permafrost, temperate rainforest, mountains, rivers and streams, lakes and wetlands, prairie, high desert, grassy meadows, and about 46 miles of marine shoreline. Bordering this region are the vast marine waters of the Puget Sound, North

DoD's Environmental Stewardship

“In the United States, DoD [the Department of Defense] manages approximately 25 million acres of land across approximately 420 large military installations (greater than 500 acres); 344 of those installations have natural resources significant enough to require active management plans.

“Access limitations due to security and safety concerns shelter many military lands from development pressures and large-scale habitat loss.

“As a result, some of the finest remaining examples of rare wildlife habitats are found on military installations. In addition, many types of military training activities and land uses are compatible with endangered species management. In fact, DoD has the highest density of species listed as threatened or endangered (T&E) under the Endangered Species Act (ESA) of any federal land management agency.”

U.S. Department of Defense, 2017

Pacific Ocean, Bering and Chukchi Seas, and Arctic Ocean. Approximately 90 percent of the land area managed by CNRNW remains undeveloped. With a few exceptions where installations are open to the public, the Region's land is kept secure from routine public access and provides undisturbed habitats for fish and wildlife.

1.1 Two Mutually Supportive Mission Dimensions

The Navy's mission is "to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas" (OPNAVINST 5090.1E, 12-3, Requirements). Integrated with this mission is the Navy's commitment to restore, protect, and enhance the quality of the environment for current and future generations (SECNAVINST 5090.8B, Policy for Environmental Protection, Natural Resources, and Cultural Resources Programs). The two mission dimensions are mutually supportive because the Navy's stewardship of the natural resources under its care sustains the healthy and robust environmental conditions needed to promote realistic training and testing, and an outdoor environment that supports activities necessary for mission preparedness.

1.2 Need for Data to Support Resource Management and Regulatory Compliance

The Navy must comply with environmental laws and their promulgated regulations as well as with Presidential Executive Orders; relevant pieces of natural resource legislation include, but are not limited to the Sikes Act, Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), Magnuson-Stevens Fishery Conservation and Management Act, Clean Water Act, and Rivers and Harbors Act. This compliance requires up-to-date information on the natural resources directly under the Navy's stewardship and in the nearshore and offshore marine environment. CNRNW, PACFLT, and NAVSEA all manage research programs and conduct ongoing studies in the northwest region to obtain and document this information.

For example, the Sikes Act requires the Department of Defense (DoD) to develop and implement Integrated Natural Resources Management Plans (INRMPs) for military installations with significant natural resources. This is accomplished in partnership with the U.S. Fish and Wildlife Service (USFWS) and state natural resource management agencies, and optionally, where marine resources are present, with the National Marine Fisheries Service (NMFS or NOAA Fisheries). CNRNW includes 12 installations that have prepared INRMPs and meet annually with their Sikes Act partner agencies to review completed natural resource studies and plan future research.

This report summarizes the environmental research and natural resource management projects that have been conducted by the Navy in the northwest region from FY 2010 to FY 2019. The studies and projects are summarized by the following categories:

- Marine Mammal Surveys and Monitoring
- Fish Surveys and Habitat Assessments
- Avian Surveys and Monitoring
- Other Species Surveys
- Forest and Vegetation Management
- Partnerships for Habitat Improvement, Restoration, and Research
- Compensatory Mitigation for Loss of Aquatic Resources
- Tribal Treaty Mitigation

Appendix A lists all projects, including a description, year(s) executed, and funding type.

Appendix B provides citations of the Navy's reports on natural resources studies and projects.

This page is intentionally blank.

2. Natural Resource Projects and Expenditures, FY 2010 to FY 2019

The Navy conducts needs assessments throughout each year to prioritize projects to be recommended for inclusion in the annual Program Objective Memorandum (POM), or project programming, cycle. These projects address a wide range of environmental management needs, such as habitat enhancement for ESA-listed species, forest management, and invasive species control, as well as regional surveys and studies to collect data to support agency consultations under the ESA, MMPA, and other federal laws and regulations. The projects add value by helping to sustain mission readiness, enhancing environmental quality, and fostering public trust and acceptance of the Navy's presence and activities on land and at sea. In addition, as a key component of the National Environmental Policy Act (NEPA) process, environmental planners identify potential compensatory and tribal treaty mitigation projects to support permitting and Government-to-Government consultations required for programmed Military Construction (MILCON) projects and training and testing activities. Compensatory and tribal treaty mitigation projects are typically funded by MILCON dollars, which are allocated separately by Congress and distinct from the funds that otherwise support natural resource projects. The following sections summarize expenditures on NRNW natural resource projects from FY 2010 to FY 2019 and describe the categories of projects programmed and budgeted annually within the Region.

2.1 Summary of Expenditures and Trends by Natural Resource Project Category

From FY 2010 to FY 2019, the Navy spent \$64,690,274 on natural resource projects in NRNW, averaging about \$6.5 million per year but varying annually. Figure 1 charts the total expenditure by fiscal year, and Table 1 shows how this expenditure was allocated annually by project category. In some cases no project expenditure is shown in a category for a given year. This is because surveys are sometimes scheduled for alternating years or, in the case of compensatory and tribal treaty mitigation, because MILCON funds covering a multi-year project may have been awarded in a preceding year.

2.2 Discussion of Expenditures and Trends, FY 2010 to FY 2019

Although annual expenditures over the ten fiscal years show a moderately increasing trend from FY 2010 to FY 2019, there were large increases in FY 2012, FY 2017, and FY 2018 (Figure 1). These were driven by mitigation costs associated primarily with three major in-water MILCON projects: the construction of the new Pier B for aircraft carrier maintenance at Puget Sound Naval Shipyard on Naval Base (NAVBASE) Kitsap Bremerton, and the construction of Explosive Handling Wharf II and the Land-Water Interface on NAVBASE Kitsap Bangor. There are two kinds of mitigation that in-water MILCON projects in NRNW typically require: (1) compensatory

mitigation for loss of aquatic resources resulting from projects involving dredge or fill discharges into waters of the U.S., and (2) tribal treaty mitigation for impacts to treaty protected rights and resources. Mitigation projects, however, are a small portion of the total number and variety of NRNW natural resource projects conducted annually. Individually and cumulatively, these add value to the diversity and productivity of fish and wildlife and their habitats, as well as to scientific knowledge about these resources.

Figure 1. Navy Northwest Region total annual expenditures on natural resource projects, FY 2010 to FY 2019

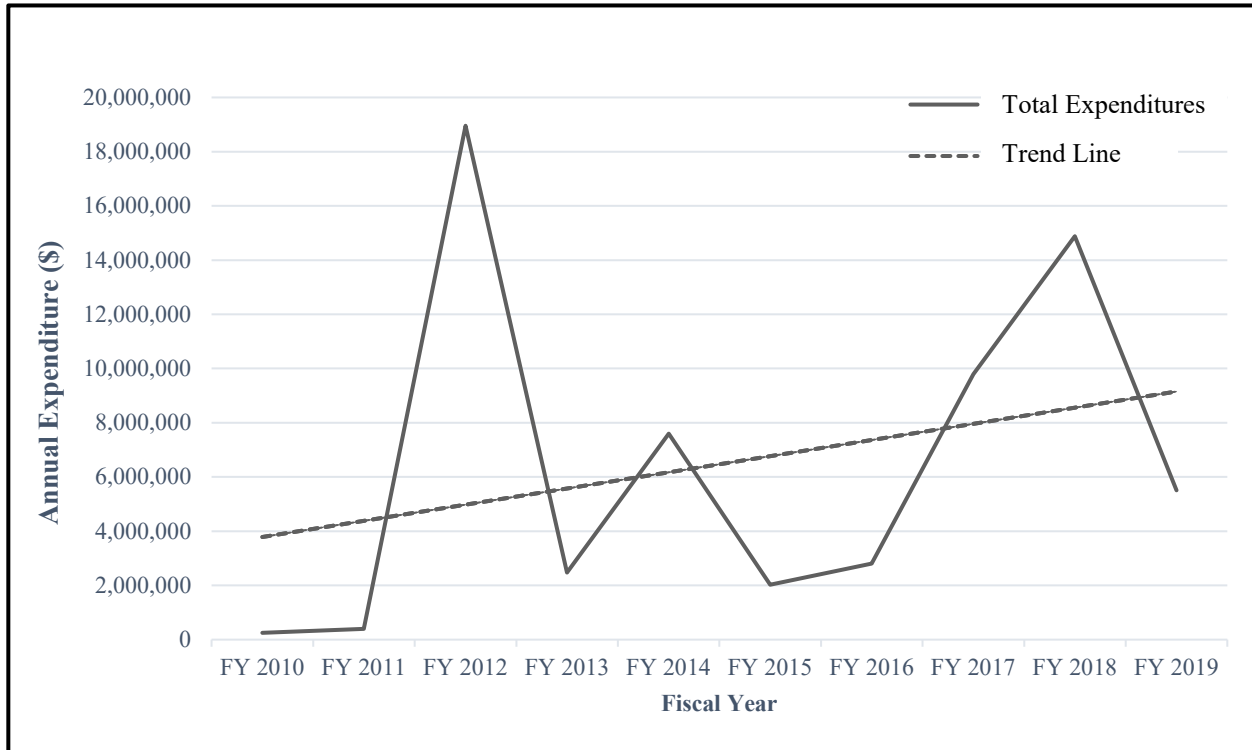


Table 2-1. Expenditures (\$) by Natural Resource Project Category, FY 2010 to FY 2019

Category	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	Total
Marine Mammal Surveys and Monitoring	0	130,781	902,772	1,195,450	1,340,852	733,268	370,036	914,298	568,775	728,653	6,884,885
Fish Surveys and Habitat Assessments	38,582	35,315	613,822	623,207	1,079,270	369,644	316,514	400,080	758,874	915,359	5,150,667
Seabird and Raptor Monitoring and Surveys	0	0	531,833	0	103,063	131,963	200,481	600,385	31,564	473,670	2,072,959
Other Species Surveys ^{1,2}	0	0	110,811	475,614	1,834,738	271,316	238,850	88,676	265,566	21,620	3,307,191
Habitat Improvement and Restoration ³	102,861	93,711	337,944	129,290	2,250,272	301,654	357,096	470,880	2,712,512	211,984	6,968,204
Forest and Vegetation Management	68,102	38,700	50,080	40,200	912,056	139,946	109,625	81,232	86,453	713,738	2,240,132
Compensatory Mitigation for Loss of Aquatic Resources	0	74,014	16,408,563	0	72,557	76,921	55,757	618,457	8,060,511	96,245	25,463,025
Tribal Treaty Mitigation	41,125	19,804	0	13,150	0	3,850	1,155,757	6,617,400	2,400,000	2,352,125	12,603,211
Total	250,670	392,325	18,955,825	2,476,911	7,592,808	2,028,562	2,804,116	9,791,408	14,884,255	5,513,394	64,690,274

¹ Includes terrestrial mammals, other birds, reptiles, amphibians, and invertebrates.

² Includes annual expenditures totaling \$2,459,022 from 2013 through 2019 implementing the Washington Ground Squirrel Conference Opinion for NWSTF Boardman (see Section 3.4 and Appendix A).

³ Includes research partnerships with other agencies and non-governmental organizations.

This page is intentionally blank.

Compensatory mitigation for loss of aquatic resources stands out as the single largest cost driver for natural resource-related projects in NRNW, accounting for about 39 percent of total natural resource project expenditures from FY 2010 through FY 2019. Tribal treaty mitigation has required a smaller expenditure, accounting for about 20 percent of the 10-year total. Other cost drivers are periodically recurring surveys and monitoring of marine mammals, fish, birds, and other wildlife, which together account for about 27 percent of total natural resource project expenditures from FY 2010 through FY 2019. These focus mainly on ESA-listed species and their food sources and habitats that occur, or could occur, within onshore or marine areas controlled by the Navy or used by the Navy for training and testing. For example, Southern Resident killer whales (SRKW) (*Orcinus orca*), a subpopulation listed as endangered under the ESA, enter Puget Sound each summer and fall to feed on Puget Sound Chinook salmon (*Onchorhynchus tshawytscha*) and other important salmonid species. In turn, the salmon are dependent on smaller forage fish that spawn on installation beaches, and during various life stages salmon and forage fish all utilize nearshore marine and riparian habitats on NRNW installations. These food-web interdependencies drive requirement under the ESA for surveys and monitoring, and it is important to note that both the SRKW and salmonids are high-profile subjects of intense agency concern and public attention in the Pacific Northwest (NOAA Fisheries, 2020a).

All whales and dolphins (cetaceans), and seals and sea lions (pinnipeds), that occur in waters along the U.S. west coast are protected by the MMPA, and 11 marine mammal species in the region are listed as threatened or endangered under the ESA (NOAA Fisheries, 2020b). The Navy conducts training and testing programs in marine waters where these species are present in varying concentrations at different times of the year. Data on the changing presence and distribution of marine mammals is required on a recurring basis for planning and situational awareness to protect these species during training and testing, and to obtain MMPA authorizations for Navy activities that have the potential to impact these species.

In compliance with the ESA and the Sikes Act, the Navy monitors the presence of marbled murrelets, a federally-listed seabird, in the marine and terrestrial environment. The marbled murrelet forages in the marine environment adjacent to Puget Sound installations and in the offshore waters of Washington State. The species nests in old growth or mature coniferous forests, and suitable marbled murrelet habitat occurs on or adjacent to many CNRNW installations

Habitat improvement and restoration projects, which are sometimes conducted in partnership with other federal agencies, state agencies, universities, foundations, and nongovernmental organizations, have accounted for about 11 percent of expenditures on natural resource projects from FY 2010 through FY 2019. Under provisions of the Sikes Act, these partnerships leverage the Navy's ability to enhance the quality of regional natural resources primarily through cooperative agreements and memoranda of understanding with other regional stakeholders including federally recognized Tribes, NOAA Fisheries, U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW), University of Washington, Paul G. Allen

Family Foundation, Kitsap County, Hood Canal Coordinating Council (HCCC), and others. The projects undertaken tend to be visible and directly beneficial to the public.

From FY 2010 through FY 2019, about 4 percent of the total expenditure on natural resource projects supported forest and vegetation management. In the foreseeable future, this management area will have an increasing role on CNRNW installations as climate adaptation and resilience become a growing consideration that will influence cost factors in the Navy's natural resource management programs (SERDP 2016). A changing climate is expected to increase the risk of wildland fires, alter plant successional patterns, and increase the distribution of invasive insect and plant species, such as Douglas-fir beetle and laminated root rot fungus, on CNRNW installations, impairing forest health and altering habitat functions and values. Changes in plant cover, compounded by extreme weather events, may lead to fires, flooding, and soil erosion that could affect the ability of the installations to conduct routine mission-essential operations as well as training and testing activities, and place built infrastructure at risk (Stein et al., 2019, 2020). As climate-related alterations in plant communities become more evident in the future, strategies to manage and adapt resiliently to these changes will be necessary (DOD DIRECTIVE 4715.21, Climate Change Adaptation and Resilience). Implementing these strategies will rely on the expertise of forest and vegetation management professionals, and require programming and budgetary allocations to implement projects that protect built and natural infrastructure on CNRNW installations.

3. Natural Resource Project Examples

Natural resource management projects, i.e., surveys, habitat improvements, and monitoring, are programmed and funded by various funding sources: CNIC, NAVSUP, PACFLT, NAVSEA, and MILCON. The NRNW Natural Resources program has been divided into eight broad, sometimes overlapping categories. This section provides representative examples of projects by category. Appendix A provides a complete list of NRNW onshore and marine projects funded by the Navy from FY 2010 to FY 2019.

3.1 Marine Mammal Surveys and Monitoring

Aerial Survey of Marine Mammals Conducted in the Inland Puget Sound Waters

The Navy funded aerial marine mammal surveys in the inland regions of Puget Sound to better understand seasonal in-water density and abundance of marine mammals. Six survey events were conducted between 2013 and 2016, spanning the four seasons of the annual year.

Researchers confirmed 11 marine mammal species in a total of 5,772 groups for an estimated 10,673 individuals. Species are listed in descending order of frequency: harbor seal (*Phoca vitulina*), harbor porpoise (*Phocoena phocoena*), California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias jubatus*), humpback whale (*Megaptera novaeangliae*), gray whale (*Eschrichtius robustus*), common minke whale (*Balaenoptera acutorostrata*) in the Strait of Juan de Fuca, Risso's dolphin (*Grampus griseus*), Dall's porpoise (*Phocoenoides dalli*), killer whale, and otter (river otter [*Lontra canadensis*] or sea otter [*Enhydra lutis*]). Harbor seals and harbor porpoise individuals alone accounted for 94 percent of marine mammal sightings (Figure 2).

Current Status: Complete

Funding: CNIC and PACFLT funded

Report: Smultea et al. 2016



Figure 2. Harbor seal mother and pup. Photo by D. Steckler under NMFS permit 15569.

Satellite Tag Tracking and Behavioral Monitoring of Male California Sea Lions

The NMFS Marine Mammal Laboratory, in collaboration with WDFW, conducted a study of adult male California sea lions with two objectives: 1) Estimate the abundance of sea lions present at Navy installations in Puget Sound; and 2) Describe how adult male sea lions utilize the waters of Washington as marine foraging areas. To accomplish the first objective, weekly counts of sea lions were conducted at four Navy installations. To accomplish the second objective, satellite dive recorders were deployed on 30 adult male California sea lions in December, January, and February 2014 through 2016. These satellite tags recorded data on the proportion of time the animals were



Figure 3. Adult male California sea lion with newly applied satellite tag hauled out on the Port Security Barrier at Naval Base Kitsap Bremerton. Photo by NMFS.

hauled out, their distribution, and their diving behavior as they foraged in inland and coastal waters (Figure 3).

A total of 675 daily counts were collected at Naval Base Kitsap Bangor, Puget Sound Naval Shipyard Bremerton, Manchester Fuel Department, and Naval Station Everett between 2014 and 2016. Abundance at all of the facilities was highest in October and November, followed by March and April.

estimated that in total, they collected nearly 60,000 hourly locations for 30 sea lions, and 234,034 dives and 12,786 hours of haul out behavior for 26 animals, representing 67 animal-months of behavior. The study concluded that while the majority of males spent less than four weeks in the Puget Sound inland waters, ten of the individuals remained in Puget Sound for up to four months, and two individuals travelled from Sinclair Inlet to Hood Canal and used Naval Base Kitsap Bangor as a haulout location.

From the satellite dive recorders, the scientists

Current Status: Complete

Funding: CNIC

Report: Delong et al. 2017

3.2 Fish Surveys, Aquatic Habitat Assessments, and Fish Management

Marine Threatened and Endangered Fish Surveys at Puget Sound Navy Installations

The Navy funded WDFW's Puget Sound Marine Fish Science Unit to investigate the potential occurrence of ESA-listed salmonids, ESA-listed rockfish, and their associated habitats in the nearshore marine environment of Puget Sound Navy installations between 2012 and 2017. These surveys included a variety of methods, including the deployment of beach seines, acoustic surveys, remotely operated vehicles, and genetic analysis. This cooperative effort resulted in at least seventeen individual survey reports and has helped inform the Navy ESA-compliance and installation management of sensitive species and habitats.

WDFW documented salmonids and forage fish across all sampled installations (Table 3-1). Documented forage fish include Pacific sand lance (*Ammodytes hexapterus*), surf smelt (*Hypomesus pretiosus*), and Pacific herring (*Clupea pallasii*).

Table 3-1. Salmonids observed in the nearshore environment by WDFW at NRNW installations during multiple years of survey effort, between 2012 and 2017.

	Chinook Salmon <i>Oncorhynchus tshawytscha</i>	Chum Salmon <i>O. keta</i>	Steelhead <i>O. mykiss</i>	Bull Trout <i>Salvelinus confluentus</i>	Cutthroat Trout <i>O. clarkii</i>	Pink Salmon <i>O. gorbuscha</i>	Coho Salmon <i>O. kisutch</i>	Sockeye Salmon <i>O. nerka</i>
NAVSTA Everett	X	X					X	
NBK Manchester Fuel Department	X	X			X	X		X
NAS Whidbey Island - Crescent Harbor	X	X	X	X	X	X	X	
NAS Whidbey Island - Lake Hancock	X	X	X			X	X	X
NBK Bangor	X	X			X	X	X	
NAVMAG Indian Island	X	X			X	X	X	
NBK Zelatched Point	X	X		X	X	X	X	X

Major conclusions from the rockfish portion of this study include the following:

- Very little rocky habitat or complex structure was recorded at any of the installations.

- No ESA-listed rockfish habitat was observed at Naval Base Kitsap Bremerton, Keyport, or Naval Station Everett.
- No ESA-listed rockfish were recorded at any of the seven Puget Sound Navy installations surveyed.
- Other rockfish species observed were always associated with anthropogenic structures (Figure 4); however, not all surveyed structures had rockfish.
- Potential juvenile recruitment habitat was identified at some installations.
- Data collected during these surveys was incorporated into larger Puget Sound rockfish habitat database to supplement regional knowledge of the species.



Figure 4. Rockfish observed by WDFW's Remotely Operated Vehicle (ROV) in the Naval Base Kitsap Bangor's nearshore environment. Photo by Dayv Lowry.

Current Status: Completed

Funding: CNIC

Reports: Frierson et al. (15 reports between 2016 and 2018); Lowry et al. 2013; Small et al. 2017

Lake Surveys and Salish Sucker Genetics Survey

The Navy funded WDFW to conduct Salish sucker (*Catostomus catostomus*) surveys in the Twin Lakes area at NRS(T) Jim Creek (Figure 5). The objectives of this study were to (1) evaluate the presence of Salish sucker within lake habitats and beaver pond complexes between Upper Twin Lake and Cub Creek Reservoir; and (2) describe the native fish fauna inhabiting Upper Twin Lake.

Over one hundred Salish sucker individuals were caught during this trapping effort, along with reidside shiner (*Richardsonius balteatus*), speckled dace (*Rhinichthys osculus*), and coastal cutthroat trout (*Onchorhynchus clarkii clarkii*).



Figure 5. Salish sucker caught by WDFW. Photo by WDFW.

Additionally, the Navy has participated in a regional (west Cascades) Salish sucker genetics study since 2015, led by the U.S. Forest Service (USFS). This study is intended to help determine if the populations of the Salish sucker on the west side of the Cascades are genetically distinct from those on the east side of the range.

Current Status: Completed

Funding: CNIC

Report: Garrett and Spinelli 2017

3.3 Avian Surveys and Monitoring

Marbled Murrelet Surveys within Puget Sound Inland Waters

WDFW has conducted marbled murrelet surveys in the nearshore marine environment of CNR/NW installations in Puget Sound since 2012 during the winter and spring seasons. WDFW conduct these surveys using a line transect sampling method, in alignment with the methodology used since 2001 for the Northwest Forest Effectiveness Monitoring Program. Marbled murrelets are occasionally present along Navy installation waterfront areas and are vulnerable to high sound pressure levels from impact pile driving and other in-water activities. Seasonal abundance and distribution data from these surveys informs the impact analysis of Navy activities on marbled murrelets. These Navy survey efforts are consistent with the spring/summer murrelet monitoring effort

funded by USFWS, which allows for the comparison of population estimates for the same sampling units between seasons. The survey design is extensive throughout Puget Sound and includes 35 primary sampling units (PSUs) that are split among four strata (Figure 6). The average PSU area is 38 square kilometers and covers approximately 20 kilometers of shoreline.

Beginning in 2018, the Navy augmented the above-noted USFWS spring/summer survey effort to include same-season primary sampling units adjacent to Navy facilities within Puget Sound. The results of surveys conducted by the Navy, USFWS, WDFW, Puget Sound Ecosystem Monitoring Program, and other organizations are being compiled and analyzed to develop a comprehensive marbled murrelet population trend analysis through a Navy-funded effort with WDFW. The trend

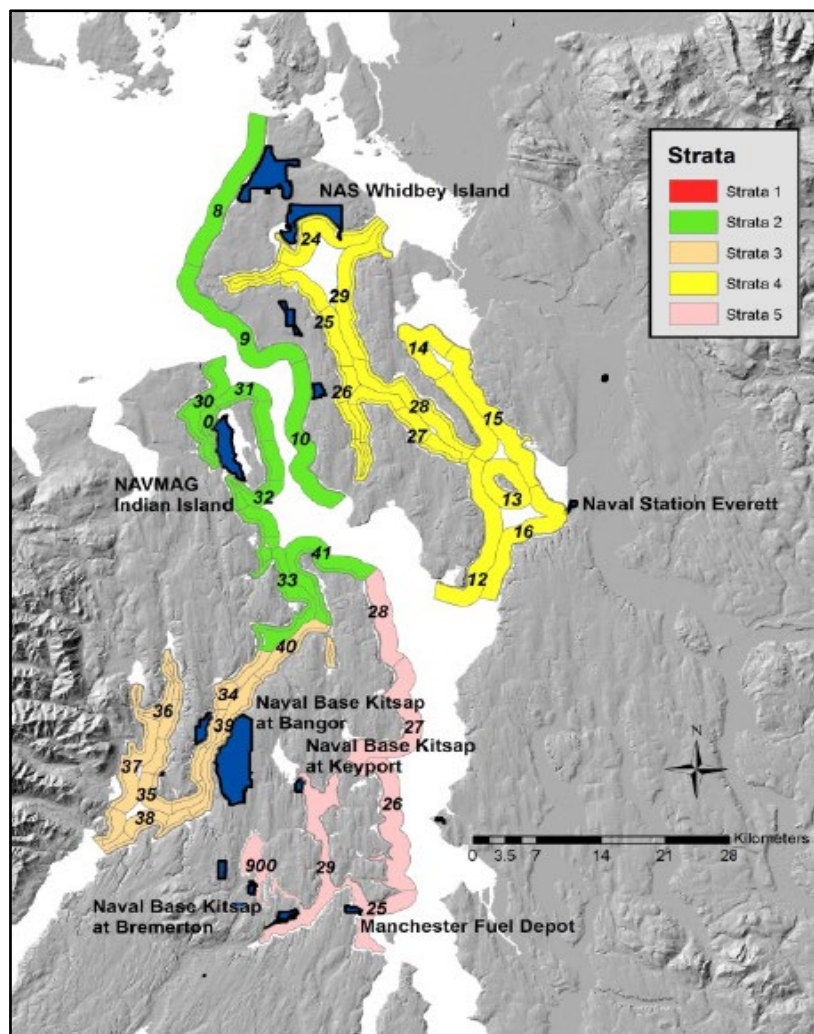


Figure 6. WDFW's primary sampling units and strata in the Puget Sound for marbled murrelet in-water surveys. (Pearson and Lance, 2018)

analysis will help fill data gaps regarding the species' seasonal abundance, population trends, and distribution throughout Puget Sound as well as the offshore area.

Current Status: Ongoing

Funding: CNIC (winter surveys) and PACFLT (spring surveys)

Reports: Pearson and Lance (seven reports between 2013 and 2019), Pearson et al. 2012

3.4 Other Species Surveys

American Pika Study at NRS(T) Jim Creek

Surveys to document the occurrence of American pikas (*Ochotona princeps*) at NRS(T) Jim Creek were conducted between 2013 and 2015 under a cooperative agreement with WDFW. The species is generally restricted to high elevation talus habitats; however, in 2009 a pika was seen at NRS(T) Jim Creek in the rock armoring that borders Jim Creek near the transmitter building, at an elevation of about 738 feet. WDFW subsequently documented pika presence at four locations ranging in elevation from 738 to 2,756 feet at NRS(T) Jim Creek (Figure 7).

This local population may have adapted behaviors that enable them to survive in low elevation sites, including altering the timing of their above-ground activities and their diets. At the time of discovery in 2009, the Jim Creek population was the only known, extant low-elevation population in Washington. However, since the discovery of this population, other biologists in the Pacific Northwest have begun looking outside the species' traditional habitat (i.e., alpine talus), and found additional pika populations in low elevation sites (e.g., Simpson 2009, Varner and Dearing 2014 and 2015, Manning and Hagar 2011, Henry et al. 2012a, 2012b).

Current Status: Completed

Funding: CNIC

Report: Milner and Cyra 2016



Figure 7. American pika observed at NRS(T) Jim Creek. Photo by WDFW.

Boardman Wildlife and Habitat Surveys, including the Washington Ground Squirrel Conference Opinion Requirements

Surveys of terrestrial wildlife, including the Washington ground squirrel, burrowing owl, and large mammals, are conducted on a recurring basis at 47,432-acre Naval Weapons Systems Training Facility (NWSTF) Boardman. Surveys for the long-billed curlew, a species of concern due to a limited and declining population, are planned for the future, along with post-wildfire habitat restoration projects for species at risk, vegetation surveys, and measures for invasive weed control.



**Figure 8. Washington Ground Squirrels.
Photo by Jodie Delavan, USFWS.**

Using the Oregon Department of Fish and Wildlife monitoring protocol, Washington ground squirrel surveys provide information confirming species presence, geographic extent of active sites, and estimates of burrow abundance at active sites, and can be compared to previous survey results for this vulnerable species.

The squirrel surveys support requirements associated with the Washington Ground Squirrel Conference Opinion for Military Readiness Activities at NWSTF Boardman (USFWS 2013). Actions associated with the Conference Opinion include two major components: (1) past, present, and future range-wide surveys for the Washington ground squirrel, a former ESA candidate species; and (2) revegetation to improve and restore habitat for this species. Continuing ground squirrel surveys will be conducted biennially after structures required for military readiness training have been completed. Habitat restoration for this species involves the removal or reduction of invasive non-native plant species and revegetation with high-quality native plant species.

Current Status: Ongoing

Funding: PACFLT, CNIC

3.5 Habitat Improvement and Restoration

Beaver Creek Restoration, Manchester Fuel Department

Beginning in 2008, the Navy and Defense Logistics Agency (Manchester Fuel Department's major tenant command), cooperated to replace an upstream blocking culvert with a natural bottom arch culvert, removed an outlet fish ladder at the mouth of the creek entering Clam Bay, reconstructed the greater estuarine habitat, and reestablished the saltwater wedge in the historic upper estuary location (Figure 9). Two thousand feet of Beaver Creek's floodplain and stream channel were restored to pre-1942 conditions, which is a significant step in Puget Sound recovery efforts.



Figure 9. Arch culvert installed over Beaver Creek, looking north toward Little Clam Bay, 2019. Photo by U.S. Navy.



Figure 10. Cutthroat trout juvenile observed in Beaver Creek during USFWS 2019 surveys. Photo by U.S. Fish and Wildlife Service.

The arch culvert accommodates tidal fluctuation into the newly created upper estuary and the estuary reconstruction carved out approximately 22,000 cubic yards of fill and restored the topography to a condition similar to pre-fill conditions. After construction, the Navy continued to invest in establishing native vegetation along the riparian corridor and control invasive species. The Defense Logistics Agency is currently replacing a fish-blocking culvert on a tributary of Beaver Creek to open more habitat to salmonids.

These efforts have succeeded in improving fish habitat. During 2019 surveys, USFWS observed that the stream provides rearing habitat for robust populations of both juvenile cutthroat trout and coho salmon (Johnson, 2020; Figure 10).

The Navy partners with the Port Orchard Rotary Club and South Kitsap Discovery Alternative High School to release coho and chum salmon fingerlings into Beaver Creek annually. Port Orchard Rotary Club owns and maintains the Karcher Creek fish rearing facility, and the high school students study the creek to determine the best habitat location to release the fingerlings to maximize the time the salmon spend in the stream. The goal of the project is to recover a maximum sustainable yield of wild, naturally spawning coho and chum salmon in Beaver Creek.

Current Status: Ongoing, as needed

Funding: CNIC, DLA, Section 404 Mitigation Funds for an Environmental Restoration effort

Report: Johnson 2020

Maylor's and Forbes Point Removal of Shoreline Armoring at NASWI

To restore forage fish spawning habitat (surf smelt and sand lance) to a degraded 2,000 linear feet of beach area on the north side of Maylor's Point in Oak Harbor, the Navy imported spawning material (approximately 7000 cy) to the site in 2013. This material was of suitable grain size for surf smelt and sand lance spawning, based on literature recommendations and historically used spawning beaches in Crescent and Oak Harbors.

Five years later, in 2018, NAS Whidbey Island cooperated with the Northwest Straits Foundation, USFWS, Island County, Puget Sound Partnership, EPA, and WDFW to remove hard shoreline armoring from the base of the feeder bluff between Maylor's Point and Forbes Point (Figure 11). Since the removal, finer sediments have accumulated on the beach and forage fish have been documented spawning in the newly available habitat (NAVFAC NW, unpublished data). NAS Whidbey Island plans to continue removing hard shoreline in cooperation with regional partners, where mission permits (i.e., does not threaten mission-critical infrastructure).



Figure 11. Section of Maylor's Point bluff before (left), and after (right) hard shoreline was removed in 2018. Photos by Northwest Straits Foundation.

Current Status: Original project completed in 2013, but forage fish monitoring is ongoing, and NASWI cooperates with regional partners on restoration projects as mission and funding allow

Funding: CNIC, in cooperation with Regional Partners

Report: Navy 2014 and Navy 2018 Surf Smelt and Pacific Sand Lance Spawning Survey Reports

3.6 Forest and Vegetation Management

Habitat and Vegetation Surveys

Navy Region Northwest is in the process of conducting a baseline vegetation inventory of herbaceous, shrub, and tree species, across its installations. Technicians delineate stands based on aerial imagery, and survey 0.05 acre plots to characterize the stand (Figure 12). Surveyors collect the following data at each plot:

- All tree, shrub, forb, and invasive species: percent cover and dominance class
- Individual mature trees (greater than eight inches Diameter at Breast Height [DBH]): species, shade tolerance, and height
- Trees smaller than an eight inch DBH: Regeneration type and age class
- Snags and downed woody debris greater than eight inches DBH: diameter, height or length, and decay class
- Habitat characteristics: potential wetlands, potential ESA habitat, nests, streams, topography, fences, old roads, etc.



Figure 12. Canopy cover (above) and large woody debris (below) at a Navy installation forest plot. Photos by U.S. Navy.

These data can be used to classify each stand in the U.S. National Vegetation Classification (USNVC) system, calculate the wildfire spread rate of an individual stand, identify dominant species, identify priority areas for invasive species removal, or identify areas which would benefit from a timber thinning action.

Current Status: Ongoing

Funding: CNIC, Navy Forestry

Report: Navy 2018, NAVMAG; Navy 2014, Manchester; others in prep

3.7 Compensatory Mitigation for Loss of Aquatic Resources

Cattail Lake Mitigation at Naval Base Kitsap Bangor

As part of a Section 404 permit to mitigate for 2.1 acres of unavoidable impacts to wetlands and waters of the U.S., the Navy removed a 57-year old road prism and replaced the culverts with a bridge to reinstate estuarine habitat off of Hood Canal on Naval Base Kitsap Bangor. The project goal was to restore tidal regimes and landscape connectivity to an artificially impounded freshwater lake and its watershed.

After the removal of the man-made dam, over 13 acres of intertidal, freshwater forest/shrub, riparian forest, and upland habitat were restored (Figure 13). In addition to the dam removal, the restoration effort included the plantings and monitoring of approximately 34,000 native shrubs and trees, restoration of tidal channels, and oyster and eelgrass habitat monitoring in the Cattail delta. The system has transformed into a series of anastomosed streams of moderate sinuosity, which usually develop evenly-spaced pools, creating ideal fish habitat. In 2020, USFWS observed a robust population of coastal cutthroat trout utilizing the restored Cattail basin (Johnson 2020).

Current Status: Construction took place between 2011 and 2013, Monitoring is ongoing

Funding: MILCON Land-Water Interface, Section 404 Compensatory Mitigation; CNIC

Reports: Navy Cattail monitoring reports (2014, 2015, 2016, 2017, 2018, 2020); Navy 2010, Cattail Creek Estuary Mitigation Plan Corps Permit #NWS-2006-1439



Figure 13. Cattail Lake (above) in 2011 prior to removal of the artificial impoundment and Cattail Estuary (below) in 2019 six years after the restoration action. Photos by U.S. Navy.

3.8 Tribal Treaty Mitigation



Figure 14. Navy volunteer during the 2019 clam seeding event (above) and clam seeds scattered on the beaches of Naval Magazine Indian Island (below). Photos by U.S. Navy.

Clam Seeding at Naval Magazine Indian Island

Clam seeding occurs annually to mitigate the installation and operation of a waterborne force protection barrier and associated within the naval restricted area (NRA) of the Naval Magazine Indian Island Ammunition Wharf – the Navy signed a twenty year Memorandum of Agreement (MOA) with the Suquamish Tribe on September 14, 2009. Manila clams are seeded at select beaches along the eastern shoreline of NAVMAG Indian Island within the marine waters of Kilisut Harbor. Per the language in the MOA, the Navy and the Suquamish Tribe agree to each provide a team of volunteers to provide the labor to perform this work (Figure 14).

Current Status: 20 year MOA; in progress (2010-2030)

Funding: MILCON funds, Port Security Barrier; CNIC

Report: Not available, Data available upon request

Kilisut Harbor Restoration

Project Description: The Navy partnered with the North Olympic Salmon Coalition, and more than a dozen other federal, state, county, tribal, and private entities (Figure 15) to replace an earthen causeway between Indian Island and neighboring Marrowstone Island with a bridge. This restoration action reconnects Oak Bay to Kilisut Harbor, opening up 2,300 acres of protected habitat in the Puget Sound to marine species, including juvenile salmonids. The Navy granted construction and access easements for the project site, participated in site surveys, and contributed design input. Additionally, the Navy contributed funds for this project through a Memorandum of Agreement with the Lower Elwha Klallam Tribe, Jamestown S’Klallam Tribe, and Port Gamble S’Klallam Tribe to mitigate for impacts to their tribal treaty resources during construction of the Land-Water Interface at NBK Bangor.

Current Status: Completed

Funding: MILCON funds, Land-Water Interface

Report: N/A;

Media article available online:

https://www.cnmc.navy.mil/regions/cnrnw/installations/naval_magazine_indian_island/news/NMI_INewsRELEASES/kilisut_harbor.html



Figure 15. Local citizens of Marrowstone Island, Navy Region Northwest Sailors, state and federal government official, and members from numerous groups around the Puget Sound and Olympic region participated in a groundbreaking ceremony for the Kilisut Harbor Restoration Project. U.S. Navy photo by Mass Communication Specialist 2nd Class Wyatt L. Anthony/Released.

This page is intentionally blank.

4. Text References

- DoD (U.S. Department of Defense). 2017. Threatened and Endangered Species on DoD Lands. Department of Defense Natural Resources Program. Two-page fact sheet.
- NOAA Fisheries. 2020a. What is Nearshore Habitat and Why Does it Matter to Orcas? Accessed at: <https://www.fisheries.noaa.gov/feature-story/what-nearshore-habitat-and-why-does-it-matter-orcas>
- NOAA Fisheries. 2020b. Species Directory. Accessed at: https://www.fisheries.noaa.gov/species-directory/threatened-endangered?species_title=&field_species_categories_vocab_target_id=All&field_species_status_value=All&field_region_vocab_target_id=All&webdam_inserts=&page=5
- SERDP (Strategic Environmental Research and Development Program). 2016. Climate-sensitive Decision-making in the Department of Defense: Synthesis of Ongoing Research and Current Recommendations. DoD Strategic Environmental Research and Development Program.
- Stein, B. A., D.M. Lawson, P. Glick, C.M. Wolf, and C. Enquist. 2019. Climate Adaptation for DoD Natural Resource Managers: A Guide to Incorporating Climate Considerations into Integrated Natural Resource Management Plans. National Wildlife Federation and U.S. Department of Defense. Washington, D.C.
- Stein, B.A., D.M. Lawson, P. Glick, and C.M. Wolf. 2020. Commander's Guide to Climate Adaptation for DoD Natural Resource Managers. National Wildlife Federation and U.S. Department of Defense. Washington, D.C.
- USFWS (United States Fish and Wildlife Service). 2013. Conference Opinion for Military Readiness Activities at the Naval Weapons Systems Training Facility Boardman, Morrow County, Oregon. (FWS Referene 01EOFW00-2013-FC-0017, Dated Dec 2, 2013)

This page is intentionally blank.

**Appendix A: Natural Resource Projects, Navy Region
Northwest, FY 2010 to FY 2019**

This page is intentionally blank

Navy Region Northwest Natural Resource Projects, FY 2010 to FY 2019

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
Ongoing	The Navy Region Northwest has 12 Integrated Natural Resources Management Plans to manage its natural resources across its shore installations. These plans both provide for the protection of the military mission at the installations and for the protection of natural resources on public lands.	Planning	CNIC	Y
MARINE MAMMAL SURVEYS AND MONITORING				
As needed	The Navy monitors for marine mammals before, during, and after pile-driving activities in the northwest.	Avoidance & Minimization	MILCON	Y
Ongoing	In cooperation with other agencies, the Navy has funded satellite tag tracking of ESA-listed Guadalupe fur seals, California sea lions, blue whales, fin whales, gray whales, humpback whales, and killer whales in the Pacific.	Study	PACFLT	Y
Ongoing	The Navy finalized hardware/infrastructure for the Marine Mammal Monitoring on Ranges (M3R) system which automated passive acoustic marine mammal detection, localization, classification, and display tools using the Navy's existing undersea hydrophone ranges. The M3R system aids visual and tagging methods, and enables comprehensive marine mammal monitoring to investigate long-term abundance and behavioral changes in the presence of sonar.	Study, Monitoring	NAVSEA	N

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
Ongoing	The Navy monitors underwater sound levels during pile driving projects, and compares sound levels when using various materials, using different mitigation techniques, and conducting the work in different environments.	Study	MILCON	Y
Ongoing since 2014	The Navy monitors pinniped haulouts on its northwest installations to obtain seasonal abundance data and trends over time; observations primarily focus on California and Steller's sea lions and harbor seals.	Monitoring	CNIC	Y
Ongoing since 2017	The Navy funded a study to determine the occurrence, movement patterns, and residency patterns of multiple humpback whale Distinct Population Segments within Pacific Ocean Navy Range Complexes.	Study	PACFLT	Y
Ongoing since 2018	The Navy has funded NOAA to use a combination of acoustic and pop-up satellite tagging technology to provide critical information on spatial and temporal distribution of salmonids to inform salmon management, U.S. Navy training activities, and SRKW conservation. The study seeks to 1) determine the occurrence and timing of salmonids within the Navy training ranges; 2) describe the influence of environmental covariates on salmonid occurrence; and 3) describe the occurrence of salmonids in relation to SRKW distribution.	Study	PACFLT	N
2014-2017	The Navy funded NOAA to conduct a multi-objective study of the distribution of Southern Resident killer whales (SRKW) in the Pacific Northwest : 1) identify and classify SRKW detections from acoustic recorders and satellite tag tracking; 2) develop a model to estimate the seasonal and annual occurrence patterns of SRKW relative to offshore Navy training ranges; and 3) characterize occurrence of anthropogenic sounds in potential SRKW habitat.	Study	PACFLT	Y

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
2014-2016	The NMFS Marine Mammal Laboratory, in collaboration with WDFW, conducted a study of adult male California sea lions with two objectives: 1) Estimate the abundance of sea lions present at Navy installations in Puget Sound; and 2) Describe how adult male sea lions utilize the waters of Washington as marine foraging areas.	Study	CNIC	Y
2013-2016	The Navy funded aerial marine mammal surveys in the inland regions of Puget Sound to better understand seasonal in-water density and abundance of marine mammals. Six survey events were conducted, spanning the four seasons of the annual year.	Study	CNIC, PACFLT	Y
FISH SURVEYS, AQUATIC HABITAT ASSESSMENTS, AND FISH MANAGEMENT				
Ongoing	USFWS is surveying Naval Base Kitsap streams to detect presence of threatened and endangered salmonids in freshwater streams that feed into Hood Canal and Puget Sound.	Study	CNIC	N
Ongoing	Prior to any in-water construction projects, the area is surveyed for submerged aquatic vegetation, so that the Navy may avoid impacts if practicable, or if impacts are unavoidable, so that the Navy may minimize and mitigate those impacts.	Avoidance & Minimization	MILCON typically	Y
Ongoing	Prior to in-water construction projects of concern, the Navy conducts sediment transport and deposition studies to assess effects of construction on the marine environment.	Avoidance & Minimization	MILCON typically	Y
2018	The Navy funded a fish entrainment study of the Bangor dry docks to better define the extent to which the dry dock operations affect ESA species	Study	NAVSEA	Y

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
2018	The Wild Fish Conservancy conducted a study of chum salmon's presence in the nearshore environment of Hood Canal. The Navy funded WDFW to conduct genetics studies to differentiate summer-run and fall-run chum populations around the Hood Canal.	Study	MILCON	Y
2017, 2018	USFWS conducted fish surveys to better define the species composition of the main stem of Jim Creek along with two smaller tributaries, which feed into the South Fork Stillaguamish River.	Study	CNIC	Y
Occasionally since 2015	The Navy does not fund these efforts; however, natural resources staff facilitate access for U.S. Forest Service to collect samples of Salish suckers in the Twin Lakes area at NRS(T) Jim Creek, to include in a regional genetics study.	Study	Agency Partner	Y
Ongoing since 2013	Navy Region Northwest surveys installation shorelines identified as potential forage fish spawning habitat to detect presence of surf smelt and sand lance eggs.	Monitoring	CNIC	Y
2014	The Navy developed a nearshore assessment tool to better understand and estimate impacts to the nearshore environment from Navy actions	Habitat Improvement	MILCON	Y
2014	The Navy evaluated 38 culverts running under the U.S. Navy Railroad that connects Shelton, Bremerton, and Silverdale, for potential fish passage barrier concerns. These data allowed the Navy to evaluate which culverts present the most significant barriers to fish passage, as well as each stream's relative habitat value, and then prioritize which culverts are the top priority for modification.	Planning	NAVBASE Kitsap	Y

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
2013	The Navy partners with the Port Orchard Rotary Club and South Kitsap Discovery Alternative High School to release coho and chum salmon fingerlings into Beaver Creek annually from the Karcher Creek fish rearing facility.	Population Management	Community Partner	N
2012-2017	WDFW conducted surveys of Navy Region Northwest nearshore areas for threatened and endangered salmonids and rockfish, including NAS Whidbey Island, NAVBASE Kitsap, and NAVSTA Everett. Other species were also documented.	Monitoring	CNIC	Y
Since the 90's, as needed	NUWC Division, Keyport assists WDFW in transferring coho from a local hatchery to the intermediary holding area in Agate Pass.	Population Management	NAVSEA	N
AVIAN SURVEYS AND MONITORING				
Ongoing	Prior to cutting trees, the Navy surveys the area for potential marbled murrelet nesting platforms and potential nesting habitat for the species.	Avoidance & Minimization	CNIC	N
Ongoing	The Navy is partnering with other research institutions to investigate auditory capability of different alcids (common murre, puffins, marbled murrelets), and behavioral responses to sound.	Study	NAVSEA	N
Annually since 2016	The Navy has funded marbled murrelet surveys in the pelagic environment in the offshore waters of Washington State, providing data on non-breeding season populations and filling data gaps regarding seabird winter distribution and abundance offshore. Sightings of other seabird species and marine mammals are also documented.	Monitoring	PACFLT	Y
Annually since 2012	WDFW conducts marbled murrelet surveys annually in the inland waters of the Puget Sound to monitor population trends and monitor presence in the nearshore areas of Navy installations.	Monitoring	CNIC and PACFLT	Y

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
2012, 2014, 2016, 2018	The Navy funded burrowing owl surveys and monitoring at NWSTF Boardman, OR.	Surveys, Monitoring	CNIC	Y
2014, 2015	The Navy funded surveys of MBTA species, that included identifying important habitats to these species	Surveys, Monitoring	CNIC	N
2011, 2012	The Navy collaborated with USFWS to determine the underwater noise injury and the non-injurious thresholds for marbled murrelets during pile driving projects.	Avoidance & Minimization	MILCON	Y
1993, 1997, 2011	The Navy surveyed the Walter Briggs Old Growth Forest located on Jim Creek to document occupancy of marbled murrelets in the forest stand. This area is designated as marbled murrelet critical habitat and is protected and managed for the species.	Surveys, Avoidance & Minimization	CNIC	N
Ongoing since 2012	The Navy monitors raptor nests for nesting activity and fledgling success at Bangor, Manchester Fuel Department, Bremerton, Keyport, Naval Hospital, and Whidbey Island. Species documented so far are bald eagles and ospreys.	Monitoring	CNIC	Y
OTHER SPECIES SURVEYS				
Ongoing	The Navy conducts wildlife and habitat surveys and habitat restoration at NWSTF Boardman, including activities associated with the Washington Ground Squirrel Conference Opinion requirements.	Monitoring	CNIC and PACFLT	N
Ongoing	Game cameras are employed on NRNW installations to document mammals using the installation.	Monitoring	CNIC	N

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
2015	WDFW surveyed Jim Creek transmitter area and found four pika populations between 738 and 2756 feet in elevation.	Monitoring	CNIC	Y
2013	The northwest region tested amphibians across seven different Navy installations for presence of <i>Batrachochytrium dendrobatidis</i> (Bd) as part of a nationwide DoD study. All installations tested have some presence of the fungus in their populations.	Monitoring	DoD PARC	Y
2013	The Navy surveyed NAVMAG Indian Island to detail the herpetofauna (reptiles and amphibians) on the installation. Similar surveys are planned for other Navy Region Northwest installations.	Monitoring	CNIC	Y
2008, 2009, 2010	The Navy facilitated access for the U.S. Forest Service to survey NRS(T) Jim Creek and Naval Base Kitsap as part of its Bat Grid Inventory and Monitoring Project. The Navy has requested funds to repeat the surveys to monitor populations and species occurrence.	Monitoring	Partner Agency	Y
HABITAT IMPROVEMENT AND RESTORATION				
Ongoing	The Navy manages invasive species across its northwest installations through several agreements, to meet different program priorities including protection of priority wildlife habitat, restoration, and supporting county eradication efforts.	Habitat Management	CNIC	N

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
Ongoing	The Navy has replaced several culverts to improve fish passage, and continues to identify culverts for replacement and/or redesign. Examples across Navy Region Northwest include the following: Bangor replaced a culvert to be fish passable and minimize the stretch of stream running underground. Bremerton redesigned a culvert under the Bremerton-to-Shelton Railroad to be fish passable. Bremerton also performs annual maintenance on certain railroad culverts (i.e., vegetation and debris removal) to ensure that the culvert remains both functional and fish passable. Manchester Fuel Department has begun construction to replace one culvert on the installation to improve fish passage on a tributary of Beaver Creek.	Habitat Management	MILCON, CNIC, DLA	N
2019	The Navy purchased 55-year restrictive easements for 8,000 acres of state-owned bedlands (aquatic lands) and 4,804 acres of DNR lands along the Dabob Bay Range Complex. This protects the Navy's testing and training mission as well as protected 4,804 acres of critical habitat for ESA-listed species.	Habitat Management	REPI program	N
2018	The Navy partnered with the Northwest Straits Foundation, USFWS, Island County, Puget Sound Partnership, and EPA to remove hard shoreline armor from the base of the feeder bluff between Maylor Point and Forbes Point.	Habitat Management	NAS Whidbey Island	N
2009, monitoring ongoing	In partnership with the Skagit River System Cooperative, the Navy restored tidal connection to Crescent Harbor Salt Marsh to improve salmonid habitat at Seaplane Base, Naval Air Station Whidbey Island.	Habitat Management	CNIC	Y

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
2006-2012	The Navy restored a one-acre estuary on Clam Bay and improved 3.5 acres of estuarine and riparian habitat along Beaver Creek, located on Manchester Fuel Department property. The Navy collaborated with the Suquamish Tribe and the Mid-Puget Sound Fisheries Enhancement group to complete these efforts.	Habitat Management	CNIC; Environmental Restoration	N
FOREST AND VEGETATION MANAGEMENT				
Ongoing since 2012	The Navy is working to establish baseline vegetation inventory of each forest stand across each of its northwest installations.	Monitoring	CNIC	Y; generally by area
Ongoing	The Nature Conservancy conducts annual population counts and maps NAS Whidbey Island's golden paintbrush population.	Monitoring	CNIC	N
Ongoing	NAS Whidbey Island manages a Garry oak stand, a Washington priority habitat. Managers protect the stand from encroaching vegetation, establish seedlings, and monitor the population.	Management	CNIC	N
2019	NAS Whidbey Island constructed deer-proof fencing around the installation's golden paintbrush population to afford better protection.	Management	CNIC	N
COMPENSATORY MITIGATION FOR LOSS OF AQUATIC RESOURCES				
Ongoing	The Navy participates in and has purchased compensatory mitigation credits from the Hood Canal Coordinating Council (HCCC) In-Lieu Fee program. HCCC invests these funds into habitat improvement projects around the Hood Canal ecosystem.	Habitat Improvement	MILCON	N
Ongoing	The Navy is collaborating with Puget Sound Restoration Fund (PSRF) and University of Washington (UW-APL) to investigate sugar kelp cultivation as a strategy for mitigating ocean acidification.	Study	MILCON	Y

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
2011, monitoring ongoing	The Navy restored tidal flow to the former Cattail Lake, functionally reverting it back to an intertidal estuarine system. As part of the restoration project, the Navy planted approximately 34,000 native shrubs and trees and restored tidal channels as needed. Monitoring of the project is ongoing including oyster and eelgrass habitat surveys in the Cattail delta.	Habitat Management	MILCON; CNIC	Y
2017	The Navy removed 7,650 cubic yards of fill located in tidelands off the south shore of inner Ediz Hook, including a stone jetty, and created 24,600 square feet of aquatic nearshore habitat, free of barriers to salmon migration. The Navy also harvested eelgrass and transplanted it in the vicinity of the restoration project.	Habitat Improvement	MILCON	N
2012	The Navy removed a derelict pier from the Kimberly Clark Facility's waterfront, near Naval Station Everett, reducing overwater coverage and improving benthic habitat.	Habitat Improvement	MILCON	N
TRIBAL TREATY MITIGATION				
Annually since 2009	The Navy partners with the Suquamish Tribe under a 20-year Memorandum of Agreement to seed clams along the eastern shoreline of NAVMAG Indian Island within the marine waters of Kilisut Harbor.	Population Management	MILCON; CNIC	N
2019	The Navy contributed funding to replace the causeway between Indian Island and Marrowstone Island with a bridge, restoring tidal exchange between Oak Bay and Kilisut Harbor and allowing salmonid migration through the salt marsh estuary between the two islands.	Habitat Management	MILCON	N

Year(s)	Project	Project Type	Funding	Report Available? (Y/N)*
2018, monitoring ongoing	The Navy funded the removal of an existing culvert at West Kingston Road, and replaced the road with a bridge, which restored tidal flow to Carpenter Creek. The Navy continues to monitor the site for effectiveness of the restoration efforts.	Habitat Management	MILCON; CNIC	Y
2018	Through an agreement with the Skokomish, the Navy funded an effort to eradicate ghost shrimp and varnish clams by removing substrate, and afterwards, to enhance the beach by seeding clams.	Population Management	MILCON	N
2018, 2016, and 2015	Through agreements with the Skokomish Tribe and Washington Department of Fish and Wildlife, the Navy funded improvements to Hood Canal fish hatcheries leading to an increase in chum salmon produced, supporting the Puget Sound Salmon Management Plan and the Hood Canal Salmon Management Plan: Enetai Hatchery, Hoodsport Hatchery, and the McKernan Hatchery.	Population Management	MILCON	N
2017	Through an agreement with the Jamestown S'Klallam, the Lower Elwha Klallam, and the Port Gamble S'Klallam, the Navy funded a beach enhancement and seeding effort, a shellfish nursery, a study focusing on potential methods to enhance geoduck beds, and a wet laboratory training facility.	Habitat Management; Population Management	MILCON	N

*Reports are available upon request to the Navy Region Northwest Public Affairs Officer, James Johnson, james.k.johnson3@navy.mil. If a report is not available, data or photos may be available upon request.

This page is intentionally blank.

**Appendix B: Natural Resource Reports, Navy Region
Northwest, FY 2010 to FY 2019**

This page is intentionally blank.

Navy Region Northwest Natural Resource Reports, FY 2010 to FY 2019

48 North Solutions. 2018. Wetland Potentiality Assessment for Naval Air Station Whidbey Island. Prepared for NAVFAC NW.

Anchor QEA. 2012. Eelgrass Survey Data Report, Naval Base Kitsap, Bangor, P-834, SSN Pier Extension and Ship Support Building. Prepared for Naval Base Kitsap Bangor, Silverdale, WA. Anchor QEA, LLC, Seattle, WA.

Arnold, A. and J. Wright. 2015. Summary of Avian Survey at Naval Magazine Indian Island Jefferson County, Washington. NAVFAC LANT, Norfolk, VA.

Beamer, E., B. Brown, K. Wolf, R. Henderson, and C. Ruff. 2016. Juvenile Chinook salmon and nearshore fish use in habitat associated with Crescent Harbor Salt Marsh, 2011 through 2015. Skagit River System Cooperative, La Conner, WA.

Berlin, D., T. Wang, and D. Peterson. 2011. Keyport Lagoon Sediment Characterization. Anchor QEA, Seattle, WA.

Cardno. 2018. Navy Dry Dock Salmon Entrainment Study at Naval Base Kitsap Bangor. Prepared for Naval Base Kitsap Bangor, Silverdale, WA. Cardno, Seattle, WA

Clifton, B. 2015. Crescent Harbor Salt Marsh restoration: 2013-2015 Vegetation Monitoring Report. Skagit River System Cooperative, La Conner, WA.

Conway, C.J., A. Macias-Duarte, V. Garcia, and C.A. Finley. 2010. Migratory linkages of burrowing owls on DoD installation and adjacent lands – final report. DoD Legacy Resource Management Program Project, 05-243, 06-243, 07-243, 08-243 and 09-243. DoD, Washington, D.C.

DeHaan, P. 2019. Fish Species Presence and Distribution Surveys at Naval Radio Station (T) Jim Creek Final Report. USFWS, Washington Fish and Wildlife Office, Lacey, WA.

Delong, R.L., S.R. Melin, J.D. Harris, P. Gearin, A.J. Orr, J.L. Laake, S. Jeffries, D. Lambourn, and J. Oliver. 2017. Satellite Tag Tracking and Behavioral Monitoring of Male California Sea lions in the Pacific Northwest to Assess Haul-out Behavior on Puget Sound Navy Facilities and Foraging Behavior in Marine Navy Testing and Training Areas. NMFS, Marine Mammal Laboratory, Alaska Fisheries Science Center; and WDFW, Olympia, WA.

- Emmons, C.K., M.B. Hanson, and M.O. Lammers. 2019. Monitoring the occurrence of Southern Resident killer whales, other marine mammals, and anthropogenic sound in the Pacific Northwest. NOAA, Northwest Fisheries Science Center. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under MIPR N00070-17-MP-4C419.
- Frierson, T., D. Lowry, L. LeClair, L. Hillier, R. Pacunski, J. Blaine, A. Hennings, A. Phillips, and M. Millard. 2018. Final Assessment of Threatened and Endangered Juvenile Rockfish Presence and Occurrence of Their Nearshore Critical Habitat Adjacent to the NAVBASE Kitsap Bangor & NAVMAG Indian Island: 2017 Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., M.P. Small, C. Bowman. 2017. Genetic Assignment of: Summer-run and Fall-run Chum Salmon Juveniles Utilizing Nearshore Habitat at the NAVBASE Kitsap Bangor, NAVMAG Indian Island, NAS Whidbey Island Lake Hancock. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Molecular Genetics Lab, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, L. LeClair, L. Hillier, R. Pacunski, J. Blaine, A. Hennings, A. Phillips, and P. Campbell. 2017. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence Adjacent to the NAVBASE Kitsap Bangor: 2015-16 Beach Seine Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, L. LeClair, L. Hillier, R. Pacunski, J. Blaine, A. Hennings, A. Phillips, and P. Campbell. 2017. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence Adjacent to Zelatched Point: 2016 Beach Seine Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, R. Pacunski, L. LeClair, J. Blaine, L. Hillier, J. Beam, A. Hennings, E. Wright, A. Phillips, C. Wilkinson, and P. Campbell. 2016. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence and Their Critical Habitat Occurrence Adjacent to Zelatched Point Pier - 2015 Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, L. LeClair, L. Hillier, R. Pacunski, J. Blaine, A. Hennings, A. Phillips, and P. Campbell. 2017. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence Adjacent to the NAVMAG Indian Island: 2015-16 Beach Seine Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.

- Frierson, T., W. Dezan, D. Lowry, L. LeClair, L. Hillier, R. Pacunski, J. Blaine, A. Hennings, A. Phillips, and P. Campbell. 2017. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence Adjacent to the Manchester Fuel Department: 2015-16 Beach Seine Survey Results. For Cooperative Agreements N44255-13-2-0006 & N44255-14-2-0006. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, L. LeClair, L. Hillier, R. Pacunski, J. Blaine, A. Hennings, A. Phillips, and P. Campbell. 2017. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence Adjacent to the NAS Whidbey Island Crescent Harbor: 2015-2016 Beach Seine Survey Results. For Cooperative Agreements N44255-13-2-0006 & N44255-14-2-0006. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, L. LeClair, L. Hillier, R. Pacunski, J. Blaine, A. Hennings, A. Phillips, and P. Campbell. 2017. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence Adjacent to the NAS Whidbey Island Lake Hancock: 2015-2016 Beach Seine Survey Results. For Cooperative Agreements N44255-13-2-0006 & N44255-14-2-0006. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, R. Pacunski, L. LeClair, J. Blaine, L. Hillier, J. Beam, A. Hennings, E. Wright, A. Phillips, C. Wilkinson and P. Campbell. 2017. Assessment of Threatened and Endangered Marine and Anadromous Fish Presence and Their Critical Habitat Occurrence Adjacent to Navy Facilities in Puget Sound 2013-16 Survey Results. Presentation. For Cooperative Agreement N44255-13-2-0006. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, R. Pacunski, L. LeClair, J. Blaine, L. Hillier, J. Beam, A. Hennings, E. Wright, A. Phillips, C. Wilkinson and P. Campbell. 2016. Final assessment of threatened and endangered marine and anadromous fish presence and their critical habitat occurrence adjacent to Manchester Fuel Department: 2015 Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, R. Pacunski, L. LeClair, J. Blaine, L. Hillier, J. Beam, A. Hennings, E. Wright, A. Phillips, C. Wilkinson, and P. Campbell. 2016. Final assessment of threatened and endangered marine and anadromous fish presence and their critical habitat occurrence adjacent to the NAS Whidbey Island Crescent Harbor: 2014-15 Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.

- Frierson, T., W. Dezan, D. Lowry, R. Pacunski, L. LeClair, J. Blaine, L. Hillier, J. Beam, A. Hennings, E. Wright, A. Phillips, C. Wilkinson and P. Campbell. 2016. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence and Their Critical Habitat Occurrence Adjacent to Naval Base Kitsap – Bangor: 2014-15 Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, R. Pacunski, L. LeClair, J. Blaine, L. Hillier, J. Beam, A. Hennings, E. Wright, A. Phillips, C. Wilkinson and P. Campbell. 2016. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence and Their Critical Habitat Occurrence Adjacent to Naval Magazine Indian Island: 2014-15 Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, R. Pacunski, L. LeClair, J. Blaine, L. Hillier, J. Beam, A. Hennings, E. Wright, A. Phillips, C. Wilkinson and P. Campbell. 2016. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence and Their Critical Habitat Occurrence Adjacent to Naval Station Everett: 2015 Survey Results. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Marine Fish Science Unit, Olympia, WA.
- Frierson, T., W. Dezan, D. Lowry, R. Pacunski, L. LeClair, J. Blaine, L. Hillier, J. Beam, A. Hennings, E. Wright, A. Phillips, C. Wilkinson and P. Campbell. 2016. Final Assessment of Threatened and Endangered Rockfish (*Sebastes* spp.) Presence and their Critical Habitat Adjacent to Naval Base Kitsap at Bremerton 2013-15 Survey Results. WDFW, Marine Fish Science Unit, Olympia, WA.
- Garrett, D. and J. Spinnelli. 2017. The Presence of Salish Sucker and the Native Fish Fauna at Naval Radio Station Jim Creek, Washington. WDFW, Fish Program, Mill Creek, WA.
- GeoEngineers and Reid Middleton. 2015. Road Culvert Assessment for Fish Passage; Shelton-Bangor-Bremerton Railroad. Prepared for NAVFAC NW under Contract N44255-10-D-5000/0033. GeoEngineers, Inc., Seattle, WA and Reid Middleton, Everett, WA.
- Hanson, M.B., E.J. Ward, C.K. Emmons, and M.M. Holt. 2018. Modeling the occurrence of endangered killer whales near a U.S. Navy Training Range in Washington State using satellite-tag locations to improve acoustic detection data. NOAA, Northwest Fisheries Science Center. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under MIPR N00070-17-MP-4C419.

- Hanson, M.B., E.J. Ward, C.K. Emmons, M.M. Holt, and D.M. Holzer. 2017. Assessing the movements and occurrence of Southern Resident killer whales relative to the U.S. Navy's Northwest Training Range Complex in the Pacific Northwest. NOAA, Northwest Fisheries Science Center. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under MIPR N00070-15-MP-4C363.
- Hanson, M.B., E.J. Ward, C.K. Emmons, M.M. Holt, and D.M. Holzer. 2015. Using satellite-tag locations to improve acoustic detection data for endangered killer whales near a U.S. Navy Training Range in Washington State. NOAA, Northwest Fisheries Science Center. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under MIPR N00070-14-MP-4C762.
- Hart Crowser. 2011. Macrovegetation Survey Results P-990, Explosive Handling Wharf #2 (EHW-2) Project, Silverdale, WA. DoD Legacy Program 12-426. Hart Crowser, Seattle, WA.
- Holmes, A.L. 2011. Nesting success and abundance of long-billed curlews in the Columbia Basin. Point Reyes Bird Observatory, Bolinas, CA.
- Huff, D.D. and J.M. Smith. 2019. Characterizing the distribution of ESA listed salmonids in the Northwest Training and Testing Area with acoustic and pop-up satellite tags. NOAA, Northwest Fisheries Science Center. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under MIPR N00070-18-MP-4C592.
- Jefferson, T.A., M.A. Smultea, and K. Ampela. 2017. Harbor Seals (*Phoca vitulina*) in Hood Canal: Estimating density and abundance to assess impacts of Navy activities. Clymene Enterprises, Smultea Environmental Sciences, LLC, and HDR, Inc. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under Contract No. N62470-15-D-8006, Task Order KB05.
- Jeffries, S. 2014. Aerial surveys of pinniped haulout sites in Pacific Northwest inland waters. WDFW, Wildlife Sciences Division. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under Contract No. N62470-10-D-3011, Task Order JP02.
- Jeffries, S. 2013. Aerial surveys of pinniped haulout sites in Pacific Northwest inland waters. WDFW, Wildlife Sciences Division. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under Contract No. N62470-10-D-3011.
- Johnson, J.R. 2020. Surveys for presence of ESA-listed salmonids on Naval Base Kitsap Property. Western Washington Fish and Wildlife Conservation Office, U.S. Fish and Wildlife Service. Final report prepared for U.S. Navy under Contracts No. N68742-18-MP-001VX, N68742-19-MP-001VX, N68742-19-MP-002VX, and N68742-20-MP-001VX.

- Kagan, J.S., W.D. Robinson and L. Wise. 2011. Baseline vegetation and wildlife species data for the proposed Oregon Military Department Training Center at the Boardman Naval Training Center, Oregon. Report to Oregon Military Department. Oregon State University, Corvallis, OR.
- Lanoo, M.J., C. Petersen, R.E. Lovich, and C. Phillips. 2014. Department of Defense Amphibian Disease Survey: Natural Resources Manager Training and Data Collection. DoD Partners in Amphibian and Reptile Conservation.
- Lowry, D., R. Pacunski, L. LeClair, J. Blaine, L. Hillier, J. Beam, A. Hennings, and E. Wright. 2013. Preliminary Assessment of Rockfish (*Sebastes* spp.) and Other Groundfish Presence, Abundance, Habitat, and Prey Base Adjacent to Naval Base Kitsap at Keyport and Bremerton: 2012-13 survey results. WDFW, Marine Fish Science Unit, Olympia, WA.
- Mate, B.R., D.M. Palacios, C.S. Baker, B.A. Lagerquist, L.M. Irvine, T. M. Follett, and D. Steel. 2019. Humpback whale tagging in support of marine mammal monitoring across multiple Navy training areas in the Pacific Ocean: Preliminary summary of field tagging effort off the Pacific Northwest in Summer 2018. Oregon State University, Marine Mammal Institute. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under CA No. N62473-17-2-0001.
- Mate, B.R., D.M. Palacios, C.S. Baker, B.A. Lagerquist, L.M. Irvine, T. M. Follett, D. Steel, C.E. Hayslip, and M.H. Winsor. 2018. Baleen whale tagging in support of marine mammal monitoring across multiple Navy training areas cover the years 2014, 2015, 2016, and 2017. Oregon State University, Marine Mammal Institute. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under Contract No. N62470-15-8006-17F4016.
- Mate, B.R., D.M. Palacios, C.S. Baker, B.A. Lagerquist, L.M. Irvine, T. M. Follett, D. Steel, C.E. Hayslip, and M.H. Winsor. 2018. Marine mammal monitoring across multiple Navy training areas in the Pacific Ocean—Final report for feeding areas off the U.S. West Coast in Summer-Fall 2017, including historical data from previous tagging efforts. Oregon State University, Marine Mammal Institute. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under Contract No. N62473-17-2-0001.
- Mate, B.R., D.M. Palacios, C.S. Baker, B.A. Lagerquist, L.M. Irvine, T. M. Follett, D. Steel, C.E. Hayslip, and M.H. Winsor. 2017. Baleen whale tagging in support of marine mammal monitoring across multiple Navy training areas cover the years 2014, 2015, and 2016. Oregon State University, Marine Mammal Institute. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under Contract No. N62470-15-D-8006 (FZN1).

- Mate, B.R., D.M. Palacios, C.S. Baker, L.M. Irvine, B.A. Lagerquist, T. M. Follett, D. Steel, and C.E. Hayslip. 2017. Humpback whale tagging in support of marine mammal monitoring across multiple Navy training areas in the Pacific Ocean: Preliminary summary of field tagging effort off the U.S. West Coast in Summer-Fall 2017. Oregon State University, Marine Mammal Institute. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under Contract No. N62473-17-2-0001.
- Milner, R.L. and T.A. Cyra. 2016. American Pika (*Ochotona princeps*) Habitat and Occupancy Surveys at the Naval Radio Station (Transmitting) Jim Creek, Snohomish County, Washington. Final Report to Naval Station Everett, Contract No. N44255-16-D-2013. WDFW, Wildlife Program, Mill Creek, WA.
- Navy. 2020. Cattail Creek Estuary Mitigation Site, Year 5 Monitoring Report. Naval Base Kitsap Bangor, Silverdale, WA.
- Navy. 2019. Integrated Natural Resources Management Plan, Naval Magazine Indian Island, Port Hadlock, Washington. NAVFAC NW, Port Hadlock, WA.
- Navy. 2019. Naval Air Station Whidbey Island Ault Field Vegetation Management Plan. NAVFAC NW, Silverdale, WA.
- Navy. 2018. 2017-2018 Surveys for Spawning Surf Smelt and Pacific Sand Lance and Naval Base Kitsap Bangor, Manchester Fuel Department, and Naval Air Station Whidbey Island. NAVFAC NW, Silverdale, WA.
- Navy. 2018. 2017 Nest Monitoring Report: Investigating nest occupancy and productivity of bald eagle and osprey nests at Naval Base Kitsap Bangor, Manchester Fuel Depot, Naval Base Kitsap Keyport, Naval Hospital Bremerton, and Naval Base Kitsap Bremerton. NAVFAC NW, Silverdale, WA.
- Navy. 2018. Cattail Creek Estuary Mitigation Site, Year 4 Monitoring Report. Naval Base Kitsap Bangor, Silverdale, WA.
- Navy. 2018. Integrated Natural Resources Management Plan, Naval Base Kitsap. NAVFAC NW, Silverdale, WA.
- Navy. 2018. Integrated Natural Resources Management Plan, Naval Radio Station (Transmitter) Jim Creek. NAVFAC NW, Everett, WA.

- Navy. 2018. Integrated Natural Resources Management Plan, Naval Surface Warfare Center Acoustic Research Detachment, Bayview, Idaho. NAVFAC NW, Everett, WA.
- Navy. 2018. Naval Magazine Indian Island 2018 Baseline Vegetation Survey Report. NAVFAC NW, Silverdale, WA.
- Navy. 2017. 2016-2017 Surveys for Spawning Surf Smelt and Pacific Sand Lance at Naval Base Kitsap Bangor, Manchester Fuel Department, and Naval Magazine Indian Island. NAVFAC NW, Silverdale, WA.
- Navy. 2017. Cattail Creek Estuary Mitigation Site, Year 3 Monitoring Report. Naval Base Kitsap Bangor, Silverdale, WA.
- Navy. 2016. 2014-2015 Surveys for Spawning Surf Smelt and Pacific Sand Lance at Naval Base Kitsap Bangor, Manchester Fuel Department, and Naval Magazine Indian Island. NAVFAC NW, Silverdale, WA.
- Navy. 2016. 2015-2016 Surveys for Spawning Surf Smelt and Pacific Sand Lance at Naval Base Kitsap Bangor, Manchester Fuel Department, and Naval Magazine Indian Island. NAVFAC NW, Silverdale, WA.
- Navy. 2016. 2016 Nest Monitoring Report: Investigating nest occupancy and productivity of bald eagle and osprey nests at Naval Base Kitsap Bangor, Manchester Fuel Department, Naval Base Kitsap Keyport, and Naval Base Kitsap Bremerton. NAVFAC NW, Silverdale, WA.
- Navy. 2016. Cattail Creek Estuary Mitigation Site, Year 2 Monitoring Report. Naval Base Kitsap Bangor, Silverdale, WA.
- Navy. 2016. Integrated Natural Resources Management Plan, Naval Station Everett, Everett, Washington. NAVFAC NW, Everett, WA.
- Navy. 2016. Integrated Natural Resources Management Plan, Pacific Beach Annex, Pacific Beach, Washington. NAVFAC NW, Everett, WA.
- Navy. 2016. Inventory and Eligibility Evaluation Naval Radio Transmission Facility LaMoure, North Dakota. Naval Facilities Engineering Command, Field Activity Northwest. NAVFAC NW, Silverdale, WA.

Navy. 2016. Pinniped Surveys at Naval Base Kitsap Bangor, Manchester Fuel Department, and Naval Station Everett: Summary through June 2016. NAVFAC NW, Silverdale, WA.

Navy. 2015. 2015 Nest Monitoring report: Investigating nest occupancy and productivity of bald eagle and osprey nests at Naval Base Kitsap Bangor, Manchester Fuel Department, Keyport, and Bremerton. NAVFAC NW, Silverdale, WA.

Navy. 2015. Cattail Creek Estuary Mitigation Site, Year 1 Monitoring Report. NAVFAC NW, Silverdale, WA.

Navy. 2015. Pacific Navy Marine Species Density Database, Revised Final Northwest Training and Testing Technical Report. NAVFAC PAC, Pearl Harbor, HI.

Navy. 2015. Preliminary Wetland Report for the Flight Path Impingement Project. NAVFAC NW, Silverdale, WA.

Navy. 2014. Cattail Creek Estuary Mitigation Site, Year 0 Monitoring Report. NAVFAC NW, Silverdale, WA.

Navy. 2014. DRAFT 2014 Golden Paintbrush Population Extent Survey and Mapping. NAVFAC NW, Silverdale, WA.

Navy. 2014. Integrated Cultural Resources Management Plan. Naval Station Everett and Special Areas. NAVFAC NW, Silverdale, WA.

Navy. 2014. Integrated Pest Management Plan. Naval Station Everett, Washington. NAVFAC LANT, Norfolk, VA.

Navy. 2014. Intertidal Shellfish Survey Report Former Plating Shop/Waste Oil Spill Area, Operable Unit 2, Area 8. Naval Undersea Warfare Center (NUWC) Division Keyport.

Navy. 2014. Inventory of Amphibian Species at Manchester Fuel Depot. NAVFAC NW, Silverdale, WA.

Navy. 2014. Manchester Fuel Department Baseline Vegetation Survey. NAVFAC NW, Silverdale, WA.

Navy. 2014. Navy Region Northwest 2013-2014 Surf Smelt and Pacific Sand Lance Spawning Inventory. NAVFAC NW, Silverdale, WA.

- Navy. 2014. Summary Report 2013-2014 Wildlife Surveys at Naval Magazine Indian Island, Jefferson County, Washington. NAVFAC LANT, Norfolk, VA.
- Navy. 2014. Summary Report of Pinniped Ground Count Surveys 2014. NAVFAC NW, Silverdale, WA.
- Navy. 2013. 2013 Nest Monitoring Report: Investigating nest occupancy and productivity of bald eagle, peregrine falcon, and osprey nests at Naval Air Station Whidbey Island, Naval Magazine Indian Island, Naval Base Kitsap Bangor, Manchester Fuel Department, and Naval Undersea Warfare Center Keyport. NAVFAC NW, Silverdale, WA.
- Navy. 2013. 2013 Nest Monitoring Report: Investigating nest occupancy and productivity of bald eagle, peregrine falcon, and osprey nests at Naval Air Station Whidbey Island, Naval Magazine Indian Island, Naval Base Kitsap Bangor, Manchester Fuel Department, and Naval Undersea Warfare Center Keyport. NAVFAC NW, Silverdale, WA.
- Navy. 2013. Baseline Survey for Terrestrial Mammals at Naval Magazine Indian Island -- State of Washington Interim Report. NAVFAC LANT, Norfolk, VA.
- Navy. 2013. Final Baseline Survey for Amphibians and Reptiles at Naval Magazine Indian Island. NAVFAC LANT, Norfolk, VA.
- Navy. 2013. Integrated Natural Resources Management Plan, Naval Air Station Whidbey Island. NAVFAC NW, Oak Harbor, WA.
- Navy. 2012. Integrated Natural Resources Management Plan, Naval Weapons Station Training Facility Boardman. NAVFAC NW, Oak Harbor, WA.
- Navy. 2012. Inventory and Evaluation: The Navy's Pacific Beach Facilities, Pacific Beach, WA. NAVFAC NW, Silverdale, WA.
- Navy. 2010. Cattail Creek Estuary Mitigation Plan Corps Permit #NWS-2006-1439. Mitigation for Waterfront Security Enclave (P977). NAVFAC NW, Silverdale, WA.
- Ormsbee, P. and M. Hohman. 2010. The Bat Grid inventory and monitoring project: a regional approach to inventorying and monitoring bat populations, 2008 report. Report 08-390, Legacy Resource Management Program, Department of Defense, Washington, D.C.

- Ormsbee, P. 2011. The Bat Grid and Monitoring Project: A Regional Approach to Inventorying and Monitoring Bat Populations 2009 Report. DoD Legacy Resource Management Program. Report 09-390, Legacy Resource Management Program, Department of Defense, Washington, D.C.
- Palacios, D.M., B.R. Mate, C.S. Baker, B.A. Lagerquist, L.M. Irvine, T. M. Follett, and D. Steel. 2020. Humpback whale tagging in support of marine mammal monitoring across multiple Navy training areas in the Pacific Ocean: Final report of field tagging effort off the Pacific Northwest in Summer 2018. Oregon State University, Marine Mammal Institute. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under CA No. N62473-17-2-0001.
- Pearson, S.F. and M.M. Lance. 2019. Fall through spring 2018/2019 Marbled Murrelet At-Sea Densities In Five Strata Associated with U.S. Navy Facilities in Washington State: Annual Research Progress Report 2019. WDFW, Wildlife Science Division, Olympia, WA.
- Pearson, S.F. and M.M. Lance. 2018. Fall through spring 2017/2018 Marbled Murrelet At-Sea Densities In Five Strata Associated with U.S. Navy Facilities in Washington State: Annual Research Progress Report 2018. WDFW, Wildlife Science Division, Olympia, WA.
- Pearson, S.F. and M.M. Lance. 2017. Fall through spring 2016/2017 Marbled Murrelet At-Sea Densities In Five Strata Associated with U.S. Navy Facilities in Washington State: Annual Research Progress Report. WDFW, Wildlife Science Division, Olympia, WA.
- Pearson, S.F. and M.M. Lance. 2016. Fall through spring 2015/2016 Marbled Murrelet At-Sea Densities In Five Strata Associated with U.S. Navy Facilities in Washington State: Annual Research Progress Report. WDFW, Wildlife Science Division, Olympia, WA.
- Pearson, S.F. and M.M. Lance. 2015. Fall through spring 2014/2015 Marbled Murrelet At-Sea Densities in Five Strata Associated with U.S. Navy Facilities in Washington State: Annual Research Progress Report. WDFW, Wildlife Science Division, Olympia, WA.
- Pearson, S.F. and M.M. Lance. 2014. Fall-winter 2013/2014 Marbled Murrelet At-Sea Densities for Four Strata Associated with U.S. Navy Facilities: Annual Research Progress Report. WDFW, Wildlife Science Division, Olympia, WA.
- Pearson, S.F. and M.M. Lance. 2013. Fall-Winter 2012/2013 Marbled Murrelet At-Sea Densities for Four Strata Associated with U.S. Navy Facilities in Puget Sound: Annual Research Progress Report. WDFW, Wildlife Science Division, Olympia, WA.

- Pearson, S.F. and M.M. Lance. 2013. Fall-Winter 2012/2013 Marbled Murrelet At-Sea Densities For Four Strata Associated with U.S. Navy Facilities in Puget Sound: Annual Research Progress Report. WDFW, Wildlife Science Division, Olympia, WA.
- Pearson, S.F. and M.M. Lance. 2012. Estimating marbled murrelet densities adjacent to U.S. Navy facilities in Puget Sound: Survey protocol. WDFW, Wildlife Science Division, Olympia, WA.
- Pearson, S.F. M.M. Lance, M.G. Raphael. 2014. 2013 Washington At Sea Marbled Murrelet Population Monitoring: Research Progress Report. WDFW, Wildlife Science Division, Olympia, WA, and USDA, Forest Service, Pacific Northwest Research Station, Portland, OR.
- Petersen, C., R.E. Lovich, C. Phillips, M. Dreslik, P. Nanjappa, and M.J. Lannoo. 2013. From the mountains to the prairies – seasonal Bd responses differ by latitude and longitude at a continental scale. DoD Partners in Amphibian and Reptile Conservation.
- Rice, A.C., A.S. Berga, N. Posdaljian, M. Rafter, B.J. Thayre, J.S. Trickey, S.W. Wiggins, S. Baumann-Pickering, A. Širović, J.A. Hildebrand. 2018. Passive acoustic monitoring for marine mammals in the Gulf of Alaska temporary maritime activities area May to September 2015 and April to September 2017. University of California San Diego, Scripps Institution of Oceanography, Marine Physical Laboratory. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI under CA No. N62473-17-2-0014.
- Rice, A., S. Baumann-Pickering, A. Širović, J. Hildebrand, A.M. Brewer, A.J. Debich, S.T. Herbert, B.J. Thayre, J.S. Trickey, S.W. Wiggins. 2015. Passive acoustic monitoring for marine mammals in the Gulf of Alaska temporary maritime activities area 2014-2015. University of California San Diego, Scripps Institution of Oceanography, Marine Physical Laboratory. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI.
- Rice, A., V. Deecke, J. Ford, J. Pilkington, S. Baumann-Pickering, A. Debich, J. Hildebrand, A. Širović. 2015. Seasonality of killer whale (*Orcinus orca*) ecotypes in the Northwest Training Range Complex. University of California San Diego, Scripps Institution of Oceanography, Marine Physical Laboratory. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI.
- Schorr, G., E. Falcone, J. Calambokidis. 2013. Summary of tag deployments on cetaceans off Washington, May 2010 to May 2013. Cascadia Research. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI and NAVFAC NW, Silverdale, WA under Contract No. N62470-10-D-3011.
- Shelton, A.O., W.H. Satterhwaite, E.J. Ward, B.E. Feist, and B. Burke. 2018. Using hierarchical models to estimate stock-specific and seasonal variation in ocean distribution, survivorship,

and aggregate abundance of fall run Chinook salmon. *Canadian Journal of Fisheries and Aquatic Sciences* 76(1): 95-108.

Small, M.P., T. Frierson, C. Bowman, and G. Gee. 2017. Genetic status of coastal cutthroat trout at the NAVBASE Kitsap Bangor, Manchester Fuel Department, NAS Whidbey Island Crescent Harbor. For Cooperative Agreements N44255-14-2-0006 & N44255-15-2-0002. WDFW, Molecular Genetics Lab, Olympia, WA.

Smultea, M.A., K. Lomac-MacNair, G. Campbell, S.S. Courbis, and T.A. Jefferson. 2016. Aerial Survey of Marine Mammals Conducted in the Inland Puget Sound Waters of Washington, Summer 2013-Winter 2016. Smultea Environmental Sciences, LLC. Prepared for Commander, U.S. Pacific Fleet and Naval Sea Systems Command. Submitted to NAVFAC PAC, Pearl Harbor, Hawaii under Contract No. N62470-15-D-8006, Task Order KB05 issued to HDR, San Diego, California.

Smultea, M.A., K. Lomac-MacNair, G. Campbell, S.S. Courbis, and T.A. Jefferson. 2015. Marine mammal aerial surveys conducted in the inland Puget Sound waters of Washington, Summer 2013-Spring 2015. Smultea Environmental Sciences, LLC. Prepared for Commander, U.S. Pacific Fleet and Naval Sea Systems Command. Submitted to NAVFAC PAC, Pearl Harbor, Hawaii under Contract No. N62470-10-D-3011, Task Order JP04.

Sound Dive Center. 2010. Manchester Fuel Depot: 2010 Orchard Point Eelgrass Survey. Sound Dive Center Research Division. Prepared for NAVFAC NW, Silverdale, WA. Contract No. N62470-12-D-7002 Task Order JP06. Sound Dive Center, Bremerton, WA.

Stell. 2013. Archaeological Survey at Naval Radio Station Jim Creek, Snohomish County, WA Final Report. Stell Environmental Enterprises, Inc., Mountlake Terrace, WA.

Suquamish Tribe. 2017. Survey Data from 2009 and 2010 Fish Seining at Manchester Fuel Department and Keyport. Suquamish Tribe, Suquamish, WA.

Trickey, J.S., S. Baumann-Pickering, A. Širović, J.A. Hildebrand, A.M. Brewer, A.J. Debich, S.T. Herbert, A.C. Rice, B.J. Thayre, S.W. Wiggins . 2015. Passive acoustic monitoring for marine mammals in the Northwest Training Range Complex July 2013-April 2014. University of California San Diego, Scripps Institution of Oceanography, Marine Physical Laboratory. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI.

Tuohy, A., M. Wait, J.F. Healy, and A. Jorgenson. 2019. 2018 Hood Canal Juvenile Chum Salmon Nearshore Habitat Use Assessment. Wild Fish Conservancy, Duvall, WA.

University of Washington and Puget Sound Restoration Fund. 2018. Activity Report #1: May 31, 2018 Sugar Kelp Cultivation Investigation.

University of Washington and Puget Sound Restoration Fund. 2018. Activity Report #2: June 1 - August 21, 2018 Sugar Kelp Cultivation Investigation.

University of Washington and Puget Sound Restoration Fund. 2018. Activity Report #3: September 1 - November 30, 2018 Sugar Kelp Cultivation Investigation.

Vavrinec, J., A.B. Borde, D. L. Woodruff, J.M. Brandenberger, R.M. Thom, C.L. Wright, and V. Cullinan. 2012. Annual Adaptive Management Report for Compensatory Mitigation at Keyport Lagoon. USDOE. Univ. Calif. Press, Berkeley, CA.

Wahl, N.C. and A.M. Dux. 2015. U.S. Navy Acoustic Research Detachment Kokanee Spawning Habitat Survey Completion Report. IDFG, Coeur d'Alene, ID.

Wiggins, S.M., A.J. Debich, J.S. Trickey, A.C. Rice, B.J. Thayre, S. Baumann-Pickering, A. Širović, and J.A. Hildebrand. 2017. Summary of ambient and anthropogenic sound in the Gulf of Alaska and Northwest Coast. University of California San Diego, Scripps Institution of Oceanography, Marine Physical Laboratory. Prepared for U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI.