



ONMS SMALL BOAT PROGRAM FLEET ASSESSMENT REPORT

April 2018



1.0 EXECUTIVE SUMMARY	3
2.0 ABOUT THE OFFICE OF NATIONAL MARINE SANCTUARIES (ONMS)	4
2.1 VESSEL MISSIONS	5
2.2 ONMS PARTNERSHIPS	6
3.0 THE FLEET	7
3.1 FLEET CHARACTERISTICS	7
3.2 FLEET INVENTORY	9
4.0 FLEET MANAGEMENT	10
4.1 LIFE-CYCLE MANAGEMENT (LCM)	10
4.2 PERSONNEL MANAGEMENT	12
4.3 BUDGET PLANNING & MANAGEMENT	12
5.0 FLEET COSTS	14
5.1 OPERATING COSTS	14
5.2 ACQUISITION COSTS	15
6.0 ONMS FLEET ASSESSMENT	16
6.1 SITE REVIEWS	16
6.1.1 NORTHEAST REGION	16
6.1.2 SOUTHEAST REGION	18
6.1.3 WEST COAST REGION	19
6.1.4 PACIFIC ISLANDS	21
7.0 SUMMARY FINDINGS	22
7.1 DAYS AT SEA PERFORMED VS. RECOMMENDED	
7.2 CAPITAL REQUIREMENTS	22
7.3 OP&M BUDGET FORECASTS	23
8.0 RECOMMENDED ACTION PLAN	24
APPENDIX	25
APPENDIX A—HISTORY OF SITE EXPANSIONS	26
APPENDIX B—FLEET SERVICE LIFE SCHEDULE	29

1.0 Executive Summary

The Office of National Marine Sanctuaries (ONMS) serves as the trustee for a network of underwater parks encompassing more than 600,000 square miles of marine and Great Lakes waters. The ONMS small boat fleet is a critical tool for assessing, monitoring, and protecting some of our nation's most significant marine resources. This report summarizes the current state of the ONMS small boat fleet, provides recommendations for improving fleet management operations, and identifies potential opportunities to effectively meet the ongoing needs of the ONMS programs.

The research and work boats of the ONMS fleet are purpose-built, multi-mission, professionally maintained, and expertly operated. They are tailored to the mission needs and operating environments of the various national marine sanctuaries ranging from nearshore to remote offshore zones.

Increasing demands on an aging fleet are leading to higher operating costs as well as near and long-term challenges to maintaining safe, efficient and effective operations. To begin addressing these challenges, ONMS is refocusing our system priorities, refining management activities at individual sites, and working to find efficiencies and share expertise across the System.

In preparing this report, ONMS assessed current fleet operations, mission requirements, and life-cycle management plans to identify potential gaps between fleet capabilities and ONMS' site management plans. The recommendations in this report for updating and optimizing the fleet are driven by the following factors:

- Vessel life cycles
- Geographical expansion of sites
- Evolving requirements for environmental compliance, and
- Opportunities to improve fleet operating efficiency and fiscal responsibility

Throughout the system, ONMS is implementing programs for resource protection, research, education, monitoring and operations in conjunction with partners inside and outside of NOAA. Small boats continue to serve as critical assets that enable ONMS to carry out its mission while also building strong connections with partners who share common goals.

The conclusions from this report identify the best management practices to:

- Align the fleet capabilities to Sanctuary Management Plans;
- Leverage partnerships to the benefit of ONMS missions and partner organizations;
- Extend the service life of vessels under the Life-Cycle Management program;
- Plan responsibly for recapitalization requirements; and
- Minimize adverse environmental impacts of vessel operations.

2.0 About the Office of National Marine Sanctuaries (ONMS)

Organized within the National Oceanic and Atmospheric Administration (NOAA) and operating under the National Marine Sanctuaries Act, ONMS serves as the trustee for a network of underwater parks encompassing more than 600,000 square miles of marine and Great Lake waters. The network includes 13 national marine sanctuaries as well as Papahānaumokuākea and Rose Atoll marine national monuments. Working with diverse partners and stakeholders, ONMS programs promote responsible, sustainable uses that ensure the health of the nation’s most valued marine areas.

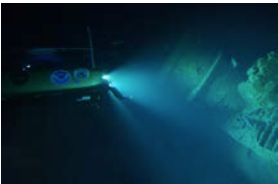


Region	Name	Designation		Area (sq mi)
Northeast	Stellwagen Bank	Sanctuary	1992	846
	Monitor	Sanctuary	1975	0.8
Great Lakes	Thunder Bay	Sanctuary	2000	4,300
Southeast	Gray's Reef	Sanctuary	1981	22
	Florida Keys	Sanctuary	1990	3,803
	Flower Garden Banks	Sanctuary	1992	56
West Coast Region	Olympic Coast	Sanctuary	1994	3,188
	Cordell Bank	Sanctuary	1989	1,286
	Greater Farallones	Sanctuary	1981	3,295
	Monterey Bay	Sanctuary	1992	6,094
	Channel Islands	Sanctuary	1980	1,470
Pacific Islands	Papahānaumokuākea	Monument	2006	582,000
	Hawaiian Islands Humpback Whale	Sanctuary	1992	1,366
	American Samoa	Sanctuary	1986	13,581

2.1 On-Water Missions

Every national marine sanctuary relies on its NOAA small boats to access its protected resources. This access is necessary for sanctuaries to implement their management plans, each of which addresses unique local challenges and opportunities. ONMS currently maintains and operates more than 45 vessels ranging from small tenders or utility boats to larger regional class boats up to 85 feet in length. These vessels are specially designed to meet the needs of each site through a wide range of activities, including:

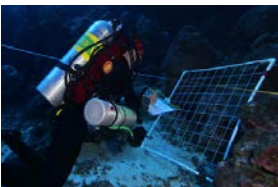
- Marine archaeology
- Research
- Ecosystem assessment surveys
- Site characterizations
- Oceanographic sampling
- Seafloor mapping
- Buoy maintenance
- Testing of emerging technologies and tools
- Damage assessment and restoration
- Law enforcement
- Education and outreach
- Whale disentanglement



Conservation and Resource Protection

The scale of protected resources within each sanctuary varies throughout the system, ranging from the site of a single Civil War shipwreck to a vast expanse of ocean surrounding remote coral reefs and tiny atolls. Section 312 of the National Marine Sanctuaries Act provides authority for the system to address injuries to sanctuary resources. The natural resource damage assessment and restoration processes are valuable resource protection tools for NOAA managers to conserve sanctuary resources for future generations.

- The ONMS research vessels *Kohola*, *Fulmar*, *Shearwater*, and *Auk* are regularly involved with whale disentanglement efforts.
- R/V *Manuma* in American Samoa supports offshore work to stop the far-reaching ecosystem damage of the invasive crown-of-thorns starfish.



Research and Monitoring

National marine sanctuaries conduct and manage monitoring programs tailored to the information needs of their area. These observations cover a wide array natural processes and human influences on water, habitat, living resources, and maritime archaeological resources. Research projects within the sanctuary system also allow scientists to address information needs that are not recognized through site characterization and monitoring.

- The R/V *Manta* conducts long-term studies of the health of Flower Garden Banks NMS using various methods, including the deployment of ROV's and the sampling of sea life and water quality.
- The R/V *Tatoosh* supports monitoring of the waters off Olympic Coast NMS with submerged data buoys, and conducts annual bird surveys while underway.

- The R/V *Shearwater* in Channel Islands NMS routinely supports conservation activities by assessing fish populations through tagging and monitoring.

Education and Outreach



Challenges facing the ocean today cross all geographic and ethnic boundaries. The system provides a place where people can find common ground and discuss possible solutions. Sanctuary education and outreach efforts link communities through innovative programs and help deepen awareness of the significance of ocean and marine ecology and ecosystems.

- The crew of the R/V *Fulmar* at the ONMS West Coast Region has recently augmented the vessel with advanced displays to better illustrate the marine data collected by the vessel in real time to visiting students and scientists.
- R/V *Manta* at Flower Garden Banks NMS conducts onboard events for schoolchildren that provide a full understanding of the sanctuary mission, activities, and vessel.

Enforcement



ONMS supports an enforcement philosophy that fosters voluntary compliance through education and promoting a sense of stewardship toward the resources of the sanctuary. Section 307 of the National Marine Sanctuaries Act authorizes NOAA to assess civil penalties for violations of sanctuary regulations. Enforcement efforts are conducted through cooperative partnerships with U.S. Coast Guard, as well as various state marine and wildlife enforcement agencies.

- Florida Keys small boats conduct patrols throughout the Florida Keys and Dry Tortugas under a Joint Enforcement Agreement with the State of Florida.
All ONMS vessels routinely observe activities throughout the national marine sanctuaries and provide information to local operators on the proper use of sanctuary resources.

2.2 ONMS Partnerships

ONMS works with a wide array of partners to implement national marine sanctuary management plans. ONMS partnerships include a network of university, community organizations, foundations, and federal, state, and local government agencies. By supporting partners' access to the protected areas and resources for additional study and education, ONMS gains additional mission benefits from its vessel assets, including a better understanding of protected resources in national marine sanctuaries.

3.0 The Fleet

3.1 Fleet Characteristics

ONMS classifies the small boats of its fleet into four categories: Class A/I, Class II, Class III, and Small Research Vessels (SRVs). Although the specific design, use, and specifications will vary by individual vessel, the general characteristics of the four classes are provided in the following table followed by examples of vessels currently in operation in each class.

	Class A/I	Class II	Class III	Class SRV
Size	16' - 25'	26' -39'	40' -65'	>65' (<300 GT)
Operational Range	50 nm Local sites	100 nm Coastal	200 nm Coastal/Offshore	>200 nm Offshore/Regional
Operating Seasons	Fair weather	~9 months	Year-round	Year-round
Passengers	Up to 6	Up to 12	Up to 20	Up to 28
Construction	Fiberglass	Fiberglass	Aluminum/Fiberglass	Aluminum/Fiberglass
Capabilities	<ul style="list-style-type: none"> ∨ Response vessel ∨ Dive platform ∨ High-speed ∨ Canopy or small cabin ∨ Trailer-able 	<ul style="list-style-type: none"> ∨ Dive platform with ladder ∨ Davit or crane ∨ Capstan or winch ∨ Enclosed cabin ∨ Basic accommodations ∨ Trailer-able 	<ul style="list-style-type: none"> ∨ Dive platform with ladder ∨ A-frame ∨ Oceanographic winch ∨ Small boat, crane ∨ Moderate speed ∨ Moderate endurance ∨ Crew quarters, galley ∨ Wet/dry lab space 	<ul style="list-style-type: none"> ∨ Dive platform with ladder ∨ Large A-frame ∨ Oceanographic winch ∨ Small boat, crane ∨ High speed ∨ Extended endurance ∨ Crew quarters, galley ∨ Quarters for scientists ∨ Wet/dry lab space



Class A/I

R/V OC-2: Olympic Coast National Marine Sanctuary's 22' high speed Rigid Hull Inflatable Boat (RHIB) is powered by two outboard engines, has a cruising speed of 35 knots and can be staged anywhere along the Washington coast. A small j-davit is mounted on the mast for use with portable block and tackle.



Class II

R/V Koholā: This 36' vessel has a maximum speed of 25 knots. It can accommodate two crewmembers and up to nine passengers. The vessel was specifically built and customized for large whale response, disentanglement and research. The vessel's primary homeport is Mā'alaea Harbor, Maui, Hawaii.



Class III

R/V Fulmar: This 67' vessel is used to support research, education, and emergency response programs for the West Coast region. Typical missions include benthic monitoring along the remote Big Sur coastline, marine mammal and sea bird observations, tagging organisms, oceanographic monitoring, archeological/cultural research, and collecting baseline ecological data. The R/V Fulmar is a hydrofoil-assisted, aluminum-hulled catamaran designed specifically to handle the sea states and conditions found in this region.



Small Research Vessels

R/V *Manta*: This 82' high-speed catamaran is primarily used as a research platform in the waters of the northwestern Gulf of Mexico in addition to hosting educational field trips and conducting emergency response in and around the sanctuary. The vessel's A-frame and winch configuration are used for a variety of projects including trawls, sediment sampling, and towing equipment such as side-scan sonar and remotely operated vehicles (ROVs). Extensive dive operations are supported by onboard facilities and equipment. The wet and dry labs allow on-board processing of samples and data. Berthing, stowage, galley, and safety equipment are geared towards multiple day operations with crews of up to ten scientists.

3.2 Fleet Inventory

ONMS Vessel Inventory, February 2017						
SANCTUARY (STATE)	VESSEL	LENGTH (FT)	CLASS	POWER	MISSION	YEAR BUILT
Stellwagen Bank (MA)	T/T Auk	11	A/I	OB1	Research	2006
	R1606	16	A/I	OB1	Research	2009
	Auk	50	III	D2	Research	2006
Monitor (VA)	Safe 25	25	A/I	OB2	Research	2003
	T/T Sand Tiger	14	A/I	OB1	Research	2005
	Sand Tiger	85	SRV	D2	Research	2005
Gray's Reef (GA)	Sam Gray	36	II	OB2	Research	2004
	Joe Ferguson	41	III	D2	Research	2008
Florida Keys Upper (FL)	Parker 1801	18	A/I	OB1	Research	1995
	Car. Skiff 2002	20	A/I	OB1	Research	1996
	Twin Vee 2204	22	A/I	OB2	Law Enf.	2008
	Proline 2402	24	A/I	OB2	Law Enf.	2002
	Mako 2502	25	A/I	OB2	Law Enf.	1995
	Manta 3007	30	II	OB2	Law Enf.	2001
	Seahunter 2902	29	II	OB2	Law Enf.	2010
	Seahunter 2903	29	II	OB2	Law Enf.	2010
	Sea Vee 3002	30	II	OB2	Law Enf.	2001
Florida Keys Lower (FL)	Agassiz	39	II	D1	Research	1987
	Carolina Skiff	16	A/I	OB1	Research	1997
	Gulfstream	28	A/I	OB2	Law Enf.	1989
	Dacat	20	A/I	OB2	Law Enf.	2004
	Proline	23	A/I	OB2	Law Enf.	2005
	Duskey	23	A/I	OB2	Law Enf.	2003
	Whaler	25	A/I	OB2	Law Enf.	1988
	Pathfinder	19	A/I	OB2	Law Enf.	2001
	Manta 3010	30	II	OB2	Law Enf.	2001
	Manta 3009	30	II	OB2	Law Enf.	2001
	Manta 3008	30	II	OB2	Law Enf.	2002
	Manta 3004	30	II	OB2	Law Enf.	2002
	Rachel Carson	39	II	D1	Research	1980
	Peter Gladding	57	III	D2	Law Enf.	2006
Flower Garden Banks (TX)	T/T Manta	14	A/I	OB1	Research	2007
	Manta	83	SRV	D2	Research	2007
Channel Islands (CA)	T/T Shearwater	11	A/I	OB1	Research	2012
	Shark Cat	28	II	OB2	Research	1987
	Shearwater	62	III	D2	Research	2002
Monterey Bay WRC (CA)	T/T Fulmar	12	A/I	OB1	Research	2007
	4107	41	III	D2	Research	2008
	Fulmar	67	III	D2	Research	2006
Olympic Coast (WA)	OC-2	20	A/I	OB2	Research	1996
	Tatoosh	38	II	D2	Research	1994
American Samoa (AS)	Manuma	33	II	OB2	Research	2007
Humpback Whale (HI)	Kohola	36	II	OB2	Research	2011
Papahānaumokuākea(HI)	Halalu	17	A/I	OB1	Research	2006
	Kaku	19	A/I	OB2	Research	2008
	Malolo	19	A/I	OB2	Research	2012
	Hihimanu	36	II	OB2	Research	2007

4.0 Fleet Management

Managing and operating a fleet of more than 45 boats at 14 sites requires constant attention to cost-effectiveness, productivity, and alignment with mission needs. For over a decade, ONMS has continually evolved and matured its fleet management operations. It is widely recognized by partners for its strong emphasis on safety, reliability, and capability. The program has taken strides in a number of areas to implement industry best practices and standard operating models for better efficiency.

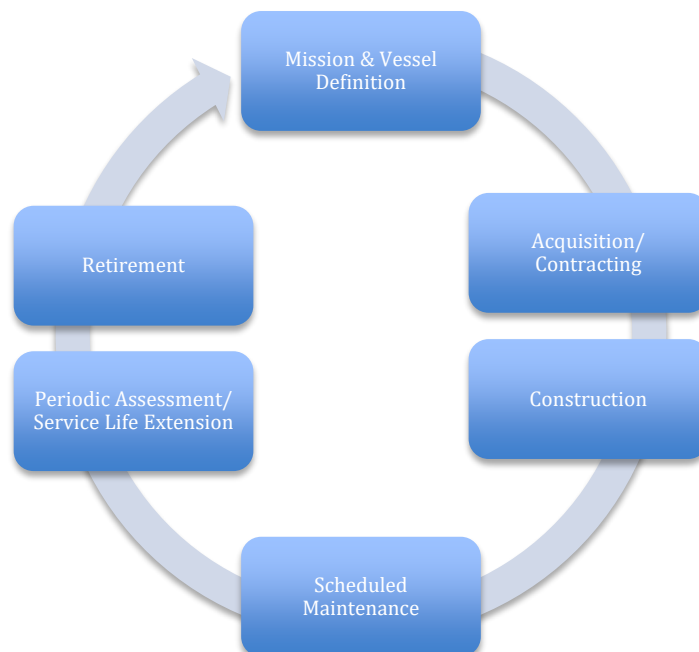
In the early years, ONMS primarily relied on a fleet of “previously-owned,” mixed model, single-mission boats along with heavy use of chartering to fulfill their on-water demands. However, as ONMS missions and programs matured, this model proved to be inefficient and unreliable for increasing mission complexity and operational tempo. In response, ONMS shifted its fleet operating model toward the use of dedicated, purpose-built multi-mission vessels that better align with mission requirements and operating environments. Although chartering still remains an option, it is less frequent and limited to specific cases because chartered vessels are rarely equipped with the necessary instruments and equipment.

The ONMS fleet management strategy focuses on three key critical components:

1. Life-Cycle Management
2. Personnel Management
3. Budget Planning & Management

4.1 Life-Cycle Management (LCM)

Life-Cycle Management ensures that vessels have the capabilities to meet mission needs and are maintained throughout their service life for optimal performance. This disciplined practice increases reliability, creates cost efficiencies, and maximizes the return on investments by extending the service life of each vessel and ensuring a mission capable fleet.



4.1.1 Mission and Vessel Definition

All ONMS vessels are designed to perform multiple missions, and incorporate proven, state-of-the-art equipment. Larger Class III and SRV vessels typically require more complex designs and specialized equipment that is tailored to mission requirements. Vessel design and equipment must also allow for expansion of systems and data handling capabilities, as well as support the use of specialized equipment such as unmanned aerial and sub-surface vehicles.

With an eye to the future, ONMS continually monitors technological advances in the marine, transportation, and industrial fields. A clear understanding of how emerging technologies such as advanced batteries, hydrogen fuel cells, and evolving propulsion systems can improve existing and new vessels is a critical management action to consider when managing a fleet that attains all mission requirements in a safe, efficient, and environmentally responsible manner.

NOAA's increasing focus on environmental compliance for all field operations, including small boats, will continue to drive innovation toward new design approaches. As such, ONMS is developing an energy efficient vessel design to maximize efficiency and minimize environmental impact of vessel operations, lessening the environmental impact of on-water operations through:

- Mammal-safe propulsion
- Reduced emissions
- Reduced noise
- Low speed, zero-emission drives
- Low wake hull forms

4.1.2 Acquisition & Construction

Anchored by a needs assessment, vessel acquisition and build specifications consider the specific mission requirements and environmental conditions in which the vessel will operate. This phase presents opportunities to incorporate emerging technologies, environmental awareness, and multi-mission features in the vessel design and construction for a long-term investment in sustainability and functionality.

4.1.3 Scheduled Maintenance

A robust preventative maintenance program is essential to fleet longevity and performance. ONMS has implemented a proprietary maintenance program known as the Vessel Information Management System (VIMS). This software performs the following functions:

- Schedule and track maintenance tasks
- Track maintenance and operational costs
- Store vessel drawings and system schematics
- Schedule and track drills
- Track fuel and material purchases
- Capture mission planning logs

All new boats enter service with a full maintenance schedule based on information in the VIMS database. Additionally, the VIMS platform serves as an important management tool by tracking key operational and cost data throughout the vessel's service life.

4.1.4 Periodic Assessments/Service Life Extensions

In addition to a regular maintenance schedule, ONMS management periodically performs extensive assessment of a vessel's performance, maintenance, and repair records relative to its scheduled service life. These periodic assessments help determine whether any refurbishments or upgrades are needed to maintain mission effectiveness or extend the vessel's service life. Upgrades can include vessel hull form

modification, propulsion system revision and replacement, and upgrades of scientific, navigational, load-handling, and auxiliary systems.

4.1.5 Retirement

Twenty years is the benchmark for useful service life of a vessel; however, factors such as local climate, sea conditions, and operating tempo may extend or shorten the actual service life of a vessel. Operating a vessel beyond its service life leads to higher operating costs, potential safety risks, and reduced availability. A key component and output of the Life-Cycle Management program is a regularly updated forecast of vessel retirement dates. Since the requirements definition, design, and construction phases for vessel acquisitions are typically a multi-year process, this schedule is a critical management and planning tool for anticipating needs and limiting disruption to operating capacity.

4.2 Personnel Management

ONMS is staffed with experienced and qualified federal and affiliate personnel who have training that on small boat industry standards. Many of the captains and crewmembers have previously served in the military, workboat industry, public outreach, and science fields. Positions ranging from Vessel Operations Coordinators (VOCs) to captains, crewmembers, and engineering personnel provide support for the full range of vessel operations.

Vessel Operations Coordinator (VOC)—The VOC is responsible for planning and scheduling all vessel operations and for coordinating operators, crewmembers, and any attending science personnel. These coordinators are typically NOAA Corps Officers with significant vessel and operations experience.

Operators—For smaller vessels, the operator will typically have passed a boat-handling course and have demonstrated a responsible attitude and requisite years of experience. For larger vessels where the number of potential passengers and the complexity of missions increase, the operator is will hold a Coast Guard license or is a bridge-certified commissioned officer.

Crew—A crewmember on any vessel is specifically assigned to assist the operator with the operation of the vessel and completion of the sanctuary mission. Crew requirements are typically determined by the complexity of the mission activities. In the case of larger vessels, a crewmember is considered part of the operational complement and may require specific certifications or to be a licensed mate capable of operating all equipment onboard. The crew is also responsible for the upkeep, inspection, and maintenance of engineering equipment, deck equipment, and other systems such as electrical or plumbing. Larger vessels may require experienced mechanics with specialized training.

Engineering Personnel—ONMS places a very high emphasis on engineering support for vessels in the field and has dedicated engineering resources for small boats. A combination of full-time and contract personnel ensure that all phases of repairs, upgrades, and new construction are conducted to professional standards and in accordance with NOAA regulations.

4.3 Budget Planning & Management

Under the current funding model, ONMS allocates its annual appropriated budget based on site-specific and system wide mission requirements. Costs for operating and maintaining vessels are included in the annual budget and reported via a standard tracking program.

Each year the full inventory of small boats in the ONMS fleet is evaluated by marine engineers and senior managers to assess winter yard work, mission operations, and scheduled maintenance requirements.

ONMS continues to explore ways to work with partners to help offset operating costs. For example, in 2016, an independent review of NOAA's fleet recapitalization efforts¹ called for an assessment of how the existing inventory of NOAA small boats can be used to satisfy some high-priority requirements typically carried out by NOAA's white ships. ONMS is working to strengthen collaborations with NOAA's Office of Marine and Aviation Operations (OMAO) to find ways to help support their requirements, and conversely, how NOAA white ships can support ONMS days at sea requirements, especially for remote offshore research and monitoring missions. Supporting NOAA fleet missions will further increase demand for sea-days and operating costs of the ONMS small boat fleet in the future.

¹ Final Report of Independent Review Team on NOAA Fleet Recapitalization – October 1, 2016

5.0 Fleet Costs

5.1 Operating Costs

A number of key factors including vessel type, age, size, as well as the frequency and types of use typically drive the total cost of maintaining and operating a vessel. Specialized equipment, personnel needs, and facilities also factor into the full operating cost of a vessel. ONMS has established standard reporting and tracking of operating costs through the VIMS program, referred to as Operations, Personnel and Maintenance (OP&M), which tracks costs across three primary categories:

- 1. Operations**—Operations costs are based on the daily expenses of operating a vessel and the number of days per year the vessel is operated. These costs primarily include fuel, oil, and other consumables. Incremental costs of replacing batteries, charts, electronic navigational data, filters, spares, and similar supplies are also included in this category. Facilities and berthing costs such as slip rentals or mooring fees are also tracked as operations expenses.
- 2. Personnel**—Personnel costs cover a mix of federal employees, affiliates, and NOAA Corps Officers supporting the full range of vessel operations. The number of personnel aboard varies based on mission requirements and vessel size and complexity. To manage personnel and resource management costs more effectively, ONMS implemented an indefinite delivery indefinite quantity (IDIQ) contract which provides standardized benefits, security, and performance measures for contract boat personnel.
- 3. Maintenance**—These costs are typically driven by vessel size, operating hours, and days at sea and include preventative maintenance as well as repair costs. For smaller vessels, the operator performs the routine maintenance and a local boat shop is contracted for more substantial work such as tune-ups and overhauls. Larger vessels have equipment that is more complex and operate more hours per year, which increase labor requirements for maintenance and repairs.

The following table provides a breakdown of OP&M costs by vessel class based on recent VIMs and site reported data. Although actual costs will vary by vessel and circumstances of use, fleet expense trends can be determined through an analysis of OP&M reports, providing insights for planning and management decision-making.

Estimated Average Annual OP&M Costs by Class					
Cost Categories		Class A/I	Class II	Class III	Class SRV
Operations	Fuel Usage (gal/hr)	5-10	20-40	50-70	110-210
	Moorage	Trailer	Trailer/Dock	Dock	Dock
	Annual Average	\$3.9K	\$8.3K	\$42K	\$93K
Personnel	Crew	1-2	1-2	2	2-4
	VOC	1	1	1	1
	Annual Average	\$7.3K	\$16K	\$112K	\$162K
Maintenance	Maintenance	Operator	Crew/Yard	Crew/Yard	Crew/Yard
	Yard/Repairs	Operator/Boatyard	Operator/Boatyard	Boatyard	Shipyards
	Annual Average	\$2.1K	\$27K	\$76K	\$192K
Average Annual Cost per Vessel		\$13.3K	\$51K	\$230K	\$447K

5.2 Acquisition Estimates

Initial acquisition and outfitting costs vary by vessel size and characteristics such as engine type, hull type, accommodations, and deck equipment. The following table provides an estimated range of vessel acquisition costs by class considering current industry averages, typical mission needs, and best-practice vessel design features and capabilities.

	Class A/I	Class II	Class III	Class SRV
Acquisition Cost Range	\$50K – \$200K	\$250K – \$1.0M	\$1.2M – \$4.5M	\$4.5M – \$8.0M

6.0 ONMS Fleet Assessment

ONMS collected and analyzed operational data to evaluate each site’s ability to meet days-at-sea recommended by site management plans with the current vessels in operation. Although missions and environments vary by site, a number of common challenges emerged from the analysis. They are:

- Aging vessels resulting in reduced reliability and increased operational expenses
- Geographical expansion resulting increased mission needs. Specifically, American Samoa, Papahānaumokuākea, Greater Farallones, and Cordell Bank have expanded geographically without a corresponding increase in the number of vessels or sea days.

6.1 Site Reviews

The following sections provide a summary of individual site and vessel reviews based on the factors discussed above. The details presented include:

- Overview of site missions and geographical considerations
- Current vessels in operation with size, year built, and primary missions
- Days at sea recommended by management plan in 2015 vs. days at sea performed
- Days at sea recommended by management plan in 2022 vs. days at sea forecast
- Notes regarding vessel condition and suitability to meet management plans

6.1.1 Northeast Region

Northeast Region: Stellwagen National Marine Sanctuary			Massachusetts
Established: 1992	Original Size: 846 sq mi	Current Size: 846 sq mi	Growth: 0%
Stellwagen Bank stretches between Cape Ann and Cape Cod, east of the Boston metropolitan area, and hosts one of the most biologically diverse ecosystems in the Gulf of Maine. The sanctuary is a critical feeding and nursery ground for several whale and dolphin species and has become one of the world’s premier whale watching destinations. The sanctuary’s position astride the historic shipping routes and fishing grounds for Massachusetts’ oldest ports also makes it a repository for shipwrecks representing several hundred years of maritime transport.			
Vessel: R/V <i>Auk</i> , length on deck 48’, built in 2006. Research and monitoring, site characterization, diving, education and outreach.			
Vessel: <i>RI606</i> , length on deck 16’, built in 2009. Research and monitoring, diving.			
Vessel: Tender to R/V <i>Auk</i> , length on deck 11’, built in 2006. Tender and dive support.			
Days at Sea	2015: 120 recommended vs. 71 performed		
	2022: 120 recommended vs. 85 forecast		
Vessel notes:			
<ul style="list-style-type: none"> ▼ Since the R/V <i>Auk</i> went into service, the site’s on-water needs have increased. A larger vessel providing increased capabilities and lifting capacity will be needed to meet future site management plan recommendations. ▼ <i>RI606</i> and the <i>Auk</i> tender will continue to perform adequately through 2022. 			

Northeast Region: Monitor National Marine Sanctuary			Virginia
Established: 1975	Original Size: 1 sq mi	Current Size: 1 sq mi	Growth: 0%
The nation's first national marine sanctuary, it protects the wreck site of the USS <i>Monitor</i> , the prototype for a class of U.S. Civil War ironclad, turreted warships that significantly altered both naval technology and marine architecture in the nineteenth century. In addition to protecting the <i>Monitor</i> archeological site, the sanctuary conducts research and outreach. Access to the site requires a transit of approximately 170 miles from base including approximately 140 miles in the open Atlantic.			
Vessel: R/V <i>Sand Tiger</i> , length on deck 85', built in 2005. Research and monitoring, site characterization, diving.			
Vessel: R/V <i>Safe</i> , length on deck 25', built in 2003. Currently in storage.			
Vessel: Tender to R/V <i>Sand Tiger</i> , length on deck 14', built in 2005. Tender and dive support.			
Days at Sea	2015: 120 recommended vs. 35 performed		
	2022: 120 recommended vs. 55 forecast		
Vessel notes:			
<ul style="list-style-type: none"> ∨ R/V <i>Sand Tiger</i> is due for a service life extension and repower to allow it to meet all mission requirements in an efficient and cost-effective manner. ∨ R/V <i>Safe</i> and the tender will perform adequately through 2022. 			

Northeast Region: Thunder Bay National Marine Sanctuary			Michigan
Established: 2000	Original Size: 448 sq mi	Current Size: 4,300 sq mi	Growth: 860%*
Located in northwest Lake Huron, this sanctuary is adjacent to one of the most treacherous stretches of water within the Great Lakes system. Fire, ice, collisions, and storms have claimed over 200 vessels in and around Thunder Bay. Today, the 4,300 square mile sanctuary protects one of America's best-preserved and nationally significant collections of shipwrecks. Due to its large area, diverse operating environments, and multi-mission modes, the sanctuary charters an array of vessel platforms. With the expansion of the sanctuary and growing regional ONMS needs, the site's vessel operations commitment will continue to increase. * <i>TBNMS has a service level agreement with NOAA's Great Lakes Environmental Research Laboratory for vessel support up to 70 days at sea per year.</i>			
Vessel: R/V <i>Laurentian</i> , length on deck 80', built in 1974. Research hand monitoring, education and outreach.			
Vessel: R/V <i>Storm</i> , length on deck 50', built in 2006. Research and monitoring, diving, site characterization.			
Vessel: <i>R3011</i> , length on deck 30', built in 2066. Research and monitoring, diving.			
Days at Sea	2015: 70 recommended vs. 65 performed		
	2022: 95 recommended vs. 65 forecast		
Vessel notes:			
<ul style="list-style-type: none"> ∨ Thunder Bay experienced significant boundary expansion in 2014. A reassessment of vessel missions is underway. ∨ R/V <i>Laurentian</i> will require replacement in the future. ∨ All other vessels will serve adequately through 2022. 			

6.1.2 Southeast Region

Southeast Region: Florida Keys National Marine Sanctuary			Florida
Established: 1990	Original Size: 3,802 sq mi	Current Size: 3,802 sq mi	Growth: 0%*
<p>Florida Keys National Marine Sanctuary protects a coral reef ecosystem that is home to one of North America's most diverse communities of underwater plants and animals. Nearly 6,000 marine species inhabit the coral reefs, mangrove forests, sea grass meadows, and other habitats of the Florida Keys, which are critical to tourism and fishing economy of the area. The sanctuary also helps preserve the nation's maritime history by protecting shipwrecks and other irreplaceable heritage resources. The sanctuary is administered by NOAA and co-managed with the state of Florida. Operating conditions are predominately in sheltered waters. In addition to research, education and outreach, boats in the sanctuary support substantial law-enforcement efforts by state and local authorities.</p> <p><i>*Key Largo was designated in 1976, and Looe Key in 1981. Both were subsumed by the FKNMS designation in 1990.</i></p>			
Vessel: R/V <i>Parker 1801</i> , length on deck 18', built in 1995. Research and monitoring.			
Vessel: FK Upper LE vessels, 8 each, lengths on deck range from 24' to 30'.			
Vessel: R/V <i>Agassiz</i> , length on deck 39', built in 1987. Buoy deployment and servicing.			
Vessel: R/V <i>Carolina Skiff</i> , length on deck 16', built in 1997. Research and monitoring.			
Vessel: FL Lower LE vessels, 11 each, lengths on deck range from 24' to 30'.			
Vessel: R/V <i>Rachel Carson</i> , length on deck 39', built in 1980. Buoy deployment and servicing.			
Days at Sea (excludes law enforcement days)		2015: 244 recommended vs. 244 performed	
		2022: 300 recommended vs. 300 forecast	
Vessel notes: <ul style="list-style-type: none"> ∨ The R/V <i>Agassiz</i> and R/V <i>Rachel Carson</i> are due for replacement. ∨ The LE vessels in FKNMS are being reviewed for repurposing potential. ∨ All other vessels will serve adequately through 2022. 			

Southeast Region: Flower Garden Banks National Marine Sanctuary			Texas
Established: 1992	Original Size: 55 sq mi	Current Size: 55 sq mi	Growth: 0%*
<p>The sanctuary is located in the open waters of the Gulf of Mexico, 70 to 115 miles off the coasts of Texas and Louisiana, and harbors the northernmost coral reefs in the continental United States. The site contains small underwater mountains created by salt domes that rise 200-500 feet from the seafloor, covered by gardens of coral, sponges, and algae that provide habitat for hundreds of shallow water Caribbean reef fish and invertebrates, manta rays, whale sharks, and coral heads. The remote location helps to maintain some of the world's healthiest remaining coral reefs.</p> <p><i>*Stetson Bank was added by act of Congress in 1997.</i></p> <p><i>Proposals for site expansion by 200-800 square miles are currently under review.</i></p>			
Vessel: R/V <i>Manta</i> , length on deck 83', built in 2007. Research and monitoring, diving, habitat characterization.			
Days at Sea		2015: 120 recommended vs. 80 performed	
		2022: 120 recommended vs. 100 forecast	
Vessel notes: <ul style="list-style-type: none"> ∨ The R/V <i>Manta</i> will need a service life extension in 2023. 			

Southeast Region: Gray's Reef National Marine Sanctuary			Georgia
Established: 1981	Original Size: 22 sq mi	Current Size: 22 sq mi	Growth: 0%
<p>This site is located 16 miles off the coast of Georgia and protects a vibrant hard-bottom that attracts more than 200 species of fish, including black sea bass, snappers, groupers, and mackerels. Crabs, lobsters, soft corals, sponges, sea stars, and other organisms form a dense carpet of living creatures. The reef is home to loggerhead sea turtles, a threatened species, and is a winter calving ground for the highly endangered North Atlantic right whale. The sanctuary is also the only protected natural reef and one of a few natural marine protected areas in the Atlantic Ocean between Cape Hatteras, North Carolina and Cape Canaveral, Florida.</p>			
Vessel: R/V <i>Sam Gray</i> , length on deck 33', built in 2004.			
Vessel: R/V <i>Joe Ferguson</i> , length on deck 41', built in 2008.			
Days at Sea		2015: 70 recommended vs. 37 performed	
		2022: 125 recommended vs. 105 forecast	
Vessel notes: <ul style="list-style-type: none"> ∨ The R/V <i>Joe Ferguson</i> will require service life extension or replacement by 2022. ∨ The R/V <i>Sam Gray</i> will serve adequately through 2022. 			

6.1.3 West Coast Region

West Coast Region: Monterey Bay National Marine Sanctuary Cordell Bank National Marine Sanctuary Greater Farallones National Marine Sanctuary			California
Monterey, Cordell Bank, and Greater Farallones sanctuaries share the following vessels:			
Vessel: R/V <i>Fulmar</i> , length on deck 67', built in 2006. Research and monitoring, diving, habitat characterization, educational outreach.			
Vessel: R/V <i>4107</i> , length on deck 41', built in 2008. Research and monitoring, diving, habitat characterization.			
Vessel: Tender to R/V <i>Fulmar</i> , length on deck 12', built in 2007. Tender and dive support.			
Monterey Bay National Marine Sanctuary			
Established: 1992	Original Size: 5,318 sq mi	Current Size: 6,093 sq mi	Growth: 15%*
Monterey Bay National Marine Sanctuary spans more than 6,000 square miles of coastal waters off central California. Within its boundaries, which includes the Davidson Seamount, are a variety of habitats, from rocky shores and lush kelp forests to an underwater canyon over 10,000 feet deep. The sanctuary's diverse marine life includes 33 species of marine mammals, 94 species of seabirds, 345 species of fish, and thousands of invertebrates. <i>*Davidson Seamount added on November 20, 2008 (774 sq mi).</i>			
Days at Sea	2015: 115 recommended vs. 75 performed		
	2022: 125 recommended vs. 75 forecast		
Cordell Bank National Marine Sanctuary			
Established: 1989	Original Size: 529 sq mi	Current Size: 1,286 sq mi	Growth: 143%*
Cordell Bank National Marine Sanctuary gets its name from the underwater mountain that rises to within 115 feet of the ocean's surface off Point Reyes, California. Upwelling of nutrient-rich deep water supports a flourishing ecosystem on and around Cordell Bank, making the sanctuary a productive feeding destination for diverse marine creatures. Common sanctuary inhabitants and migratory visitors include whales, dolphins, sea lions, seabirds, rockfish, and Pacific salmon. <i>*757 square miles added in 2015.</i>			
Days at Sea	2015: 40 recommended vs. 25 performed		
	2022: 40 recommended vs. 25 forecast		
Greater Farallones National Marine Sanctuary			California
Established: 1991	Original Size: 1,282 sq mi	Current Size: 3,295 sq mi	Growth: 157%*
Greater Farallones National Marine Sanctuary is located northwest of San Francisco Bay and encompasses protected open ocean, near-shore tidal flats, rocky intertidal areas, estuarine wetlands, sub-tidal reefs, and beaches. The sanctuary is home to some of the largest concentrations of white sharks and blue whales, along with one-fifth of California's breeding harbor seals and hundreds of thousands of breeding seabirds. The sanctuary also protects numerous estuaries, bays, and beaches for the public to enjoy. <i>*The sanctuary was expanded by 2,013 square miles in 2015.</i>			
Days at Sea	2015: 45 recommended vs. 25 performed		
	2022: 45 recommended vs. 25 forecast		
Vessel notes:			
<ul style="list-style-type: none"> ∨ A new Class I vessel is needed in Monterey Bay to support diving operations. ∨ A new Class III vessel is needed to support Greater Farallones and Cordell Bank expansion areas. ∨ The R/V <i>Fulmar</i> will require a service life extension prior to 2022. ∨ All other vessels will serve adequately through 2022. 			

West Coast Region: Channel Islands National Marine Sanctuary			California
Established: 1980	Original Size: 1,437 sq mi	Current Size: 1,470 sq mi	Growth: 2%
Located off the coast of Santa Barbara and Ventura counties in California, the sanctuary contains remarkable biodiversity, productive ecosystems, sensitive species, and habitats, as well as shipwrecks and other maritime heritage artifacts. Many valuable commercial and recreational activities, such as fishing, shipping, and tourism, occur in the sanctuary. A comprehensive ecosystem-based management approach is used to promote long-term conservation of sanctuary waters, wildlife, habitats, and cultural resources while allowing compatible human uses. Operating area includes open-ocean areas up to 85 miles from base. Some missions require endurance and accommodations to support multi-day outings.			
Vessel: R/V <i>Shearwater</i> , length on deck 62', built in 2002. Research and monitoring, diving, habitat characterization, education and outreach.			
Vessel: R/V <i>Shark Cat</i> , length on deck 28', built in 1987. Research and monitoring, diving.			
Vessel: Tender to <i>Shearwater</i> , length on deck 11', built in 2012. Tender, dive support.			
Days at Sea		2015: 160 recommended vs. 106 performed	
		2022: 160 recommended vs. 145 forecast	
Vessel notes:			
<ul style="list-style-type: none"> ∨ The R/V <i>Shearwater</i> and its tender will perform adequately through 2022. ∨ The R/V <i>Shark Cat</i> useful service life will end before 2022. Replacement is recommended. 			

West Coast Region: Olympic Coast National Marine Sanctuary			Washington
Established: 1994	Original Size: 3,188 sq mi	Current Size: 3,188 sq mi	Growth: 0%
Located off the rugged Olympic Peninsula, the sanctuary is home to numerous species of marine mammals and seabirds, diverse populations of kelp and intertidal algae, and thriving invertebrate communities. This sanctuary is also rich in cultural resources, with more than 180 documented historical shipwrecks and the vibrant contemporary cultures of the Makah, Hoh, and Quileute Tribes, and the Quinalt Indian Nation. The sanctuary is spread along about 100 miles of rugged and sparsely populated North Pacific coast, an area characterized by extreme tides, foggy conditions, and frequently challenging sea states.			
Vessel: R/V <i>Tatoosh</i> , length on deck 38', built in 1994. Research and monitoring, diving, buoy deployment and recovery.			
Vessel: R/V <i>OC-2</i> , length on deck 20', built in 1996. Research and monitoring.			
Days at Sea		2015: 64 recommended vs. 56 performed	
		2022: 85 recommended vs. 70 forecast	
Vessel notes:			
<ul style="list-style-type: none"> ∨ The R/V <i>Tatoosh</i> has exceeded its service life and is past due for replacement. ∨ <i>OC-2</i> will perform adequately through 2022. 			

6.1.4 Pacific Islands

Pacific Islands: Papahānaumokuākea Marine National Monument			Hawai'i
Established: 2006	Original Size: 139,818 sq mi	Current Size: 582,000 sq mi	Growth: 316%*
<p>This site is jointly administered by NOAA under the Department of Commerce, the Department of the Interior, the state of Hawai'i, and the semi-autonomous Office of Hawaiian Affairs. It is one of the largest conservation areas in the world. The monument's waters are home to more than 7,000 marine species, a quarter of which are found only in the Northwestern Hawaiian Islands. The area is also home to a number of endangered and threatened species such as Hawaiian monk seals and green sea turtles. Additionally, the monument has great cultural significance to Native Hawaiians and blends the management of terrestrial, marine, and cultural resources with a focus on the connections between land and sea. The waters of the monument are predominantly open-ocean.</p> <p><i>*Site was expanded by more than 440,000 square miles through Presidential Proclamation in 2016.</i></p>			
Vessel: R/V <i>Hihimanu</i> , length on deck 36', built in 2007. Dive support, training, research and monitoring.			
Vessel: R/V <i>Malolo</i> , length on deck 19', built in 2012. Dive support, research and monitoring.			
Vessel: R/V <i>Kaku</i> , length on deck 19', built in 2008. Dive support, research and monitoring.			
Vessel: R/V <i>Halalu</i> , length on deck 17', built in 2006. Training, general utility.			
Days at Sea		2015: 243 recommended vs. 228 performed	
		2022: 160 recommended vs. 130 forecast	
Vessel notes:			
<ul style="list-style-type: none"> ▼ Service life extensions are required on R/V <i>Malolo</i>, R/V <i>Kaku</i>, and R/V <i>Hihimanu</i> to maintain mission effectiveness. ▼ The R/V <i>Halalu</i> is at the end of its useful service life, but does not need to be replaced. ▼ The expansion of PMNM area in 2016 is driving a reassessment of vessel requirements. 			

Pacific Islands: National Marine Sanctuary of American Samoa			American Samoa
Established: 1986	Original Size: 0.25 sq mi	Current Size: 13,581 sq mi	Growth: 5,430,000%*
<p>NOAA co-manages this sanctuary with the government and people of American Samoa. It is located in the cradle of Polynesia's oldest culture and supports the greatest diversity of marine life in the National Marine Sanctuary System. The sanctuary is comprised of six protected areas of nearshore coral reef and offshore open ocean waters across the Samoan archipelago. The sanctuary protects extensive coral reefs, including some of the oldest and largest <i>Porites</i> coral heads in the world, deep water reefs, hydrothermal vent communities, and rare marine archaeological resources. The oldest protected area, Fagatele Bay, and two other protected areas are in relatively sheltered waters near Tutuila but require short open-water transits for access. The other three protected areas are remote and require open ocean transits of 80, 180 and 240 miles for access.</p> <p><i>*Originally designated as Fagatele Bay NMS, the expansion on July 26, 2012 added five new areas (73 sq mi) and Rose Atoll National Marine Monument (13,507 sq mi).</i></p>			
Vessel: R/V <i>Manuma</i> , length on deck 33', built in 2007. Research and monitoring, diving, habitat characterization.			
Days at Sea		2015: 150 recommended vs. 14 performed	
		2022: 150 recommended vs. 52 forecast	
Vessel notes:			
<ul style="list-style-type: none"> ▼ A service life extension on R/V <i>Manuma</i> is required prior to 2022. ▼ The large expansion of NMSAS in 2012 is driving a reassessment of vessel requirements. 			

Pacific Islands: Hawaiian Islands Humpback Whale National Marine Sanctuary			Hawai'i
Established: 1992	Original Size: 1,366 sq mi	Current Size: 1,366 sq mi	Growth: 0%
<p>The primary mission of this sanctuary is the protection of humpback whales and their habitat in Hawai'i. It is administered by ONMS and co-managed with the state of Hawaii. The sanctuary consists of five sites distributed across approximately 300 miles of the island chain. The sanctuary's shallow, warm waters surrounding the main Hawaiian Islands are one of the most important humpback whale habitats in the world. Scientists estimate that two-thirds of the entire North Pacific humpback whale population migrates to Hawaiian waters each winter to breed, calve, and nurse their young. The continued protection of humpback whales and their habitat is crucial to the long-term recovery of this endangered species. Much of the sanctuary is in protected waters to leeward of large islands. However, two areas are on the exposed northern shores of the islands and open-ocean transits are required between sanctuary management areas and sanctuary bases.</p>			
Vessel: R/V <i>Kohola</i> , length on deck 36', built in 2011. Whale disentanglement, research and monitoring.			
Days at Sea		2015: 65 recommended vs. 65 performed	
		2022: 95 recommended vs. 70 forecast	
Vessel notes:			
<ul style="list-style-type: none"> ▼ The R/V <i>Kohola</i> requires a service life extension prior to 2022. 			

7.0 Summary Findings

ONMS expects its responsibilities for managing the National Marine Sanctuary System to expand over the next five years. The section below identifies the potential for expansion of the system and corresponding operating budgets and life-cycle schedules of the fleet. The primary driver for the number of “days at sea recommended” is on-water mission requirements defined by each site’s manager.

7.1 Days at Sea Performed vs. Recommended

In 2015, 1,656 total days at sea were recommended by site managers. Of the total recommended days at sea, 1,191 (71%) days were performed. These numbers were reported by each site and include all site and partner missions performed by all vessels.

7.2 Annual Repair Requirements

Scheduled repair requirements on ONMS small boats are composed of annual yard work and service life extensions. The schedules are developed based on expected service life of the current fleet as well as existing and projected gaps in vessel capabilities relative to sites’ management plans.

7.2.1 Annual Yard Work

Winter yard work is the complimentary component of vessel maintenance that requires services outside the capability of a vessel crew. This usually includes hauling the boat for hull inspection, repairs, painting, and preservation. The average boat requires some level of hull preservation every year. The most convenient time for sanctuary vessel crew and researchers to do this work is during the winter months or early spring. Yard work is a regular part of life cycle management for a vessel. Most boat yards employ skilled technicians, welders, electricians, and engineers. The annual yard visit ensures the vessel remains healthy and in compliance while also helping to maintain a skilled labor force familiar with ONMS boats to the benefit of local communities and economies.

7.2.2 Vessel Service Life Extension Schedule

The following vessels are due for service life extensions in the next several years based on their life cycles. Service life extensions may include replacement or major refurbishment of vessel structures, engines, and onboard equipment to ensure continued reliability.

SITES	2018	2019	2020	2021	2022	2023	2024
Channel Islands		<i>Shearwater</i>					
Channel Islands		<i>Sharkcat</i>					
Papahānaumokuākea			<i>Kaku</i>				
Papahānaumokuākea			<i>Hihimanu</i>				
Papahānaumokuākea					<i>Malolo</i>		
American Samoa					<i>Manuma</i>		
Hawaiian Islands					<i>Kohola</i>		
West Coast Region					<i>Fulmar</i>		
West Coast Region						<i>4107</i>	
Stellwagen Bank						<i>Auk</i>	
Gray’s Reef						<i>Joe Ferguson</i>	
Gray’s Reef						<i>Sam Gray</i>	
Monitor	<i>Sand Tiger</i>						
							<i>Manta</i>
Projected Cost (\$K)	\$300	\$745K	\$100K	0	\$845K	\$1M	\$400K

7.2.3 Capital Repair Estimates

The following table provides capital repair cost estimates for the ONMS fleet. Capital costs include annual yard work and service life extensions. ONMS uses its Procurement, Acquisition, and Construction

appropriation for capital repairs of its small boat fleet, subject to the availability of appropriations in any given year.

	2018	2019	2020	2021	2022	2023	2024
Service Life Extension	\$300K	\$745K	\$100K	0	\$845K	\$1M	\$400K
Annual Yard Work	\$500K	\$500K	\$500K	\$500K	\$500K	\$500K	\$500K
Total Capital (PAC)	\$800K	\$1.245M	\$600K	\$500	\$1.345M	\$1.5M	\$900K

7.3 OP&M Budget Forecasts

The following table forecasts the annual Operations, Personnel, and Maintenance (OP&M) budget for the ONMS fleet. OP&M includes fixed and variable costs such as fuel, berthing, crew labor, maintenance, and repairs, but does not include capital costs. ONMS uses its Operations, Research, and Facilities appropriation for OP&M of its small boat fleet, subject to the availability of appropriations in any given year. These forecasts are based on ten years of OP&M cost history, and are adjusted for:

- Increases when vessels are added to the fleet
- Decreases when vessels are removed from the fleet
- Reductions when service life extensions temporarily decrease maintenance costs

OP&M	2018	2019	2020	2021	2022	2023	2024
Northeast Region (3 vessels)	\$0.51M	\$0.53M	\$0.61M	\$0.62M	\$0.70M	\$0.72M	\$0.86M
Southeast Region (8 vessels)	\$0.74M	\$0.77M	\$0.88M	\$0.90M	\$1.01M	\$1.04M	\$1.24M
West Coast Region (6 vessels)	\$1.06M	\$1.10M	\$1.26M	\$1.28M	\$1.45M	\$1.49M	\$1.78M
Pacific Island Region (6 vessels)	\$0.25M	\$0.26M	\$0.30M	\$0.30M	\$0.34M	\$0.35M	\$0.42M
Total OP&M Forecast	\$2.56M	\$2.66M	\$3.04M	\$3.10M	\$3.50M	\$3.60M	\$4.30M

8.0 Recommended Action Plan

1. Develop a strategy, in consultation with industry experts, for small boat fleet recapitalization including both new vessel acquisitions and service life extensions of existing vessels.
2. Standardize vessel classes to reduce design costs and streamline replacement. Capitalize on successful designs and newer technology to achieve cost effective results.
3. Conduct a benchmark study on Operations, Personnel, and Maintenance (OP&M) costs to ensure the use of best management practices and greatest operating efficiency.
4. Work with the NOAA small boat program office, and improve NOAA wide coordination of small boat maintenance, safety, and compliance.
5. Increase engagement with partners to extend utilization of ONMS vessels through cost sharing.
6. To improve mission capacity and cost effectiveness across NOAA missions, encourage closer collaboration with NOAA fleet operations to use NOAA ships for sanctuaries' missions, and conversely, support NOAA fleet missions with the ONMS small boat fleet.
7. Formally integrate life-cycle management practices, including VIMS, across 100% of the ONMS small boat fleet.
8. Develop and implement energy-efficient and environmentally compliant vessel design concepts across the ONMS fleet.

Appendix

Appendix A —History of Site Expansions

Appendix B —Fleet Service Life Schedule

Appendix A - History of Site Expansions

Year	Expansion (sq mi)	Total Area (sq mi)	Milestone
1975	3	3	Monitor NMS established
1976	1	4	Key Largo NMS established
1980	1,471	1,475	Channel Islands NMS established
1981	1,282	2,757	Gulf of Farallones NMS established
1981	22	2,779	Gray's Reef NMS established
1981	1	2,780	Looe Key NMS established
1986	1	2,781	Fagetele Bay NMS established
1989	529	3,310	Cordell Bank NMS established
1990	3,801	7,111	Florida Keys NMS established (subsuming Key Largo & Looe Key)
1992	5,318	12,429	Monterey Bay NMS established
1992	55	12,484	Flower Garden Banks NMS established
1992	846	13,330	Stellwagen Bank NMS established
1992	1,366	14,696	Hawaiian Islands Humpback Whale NMS established
1994	3,183	17,879	Olympic Coast NMS established
1996	1	17,880	Stetson Bank added to Flower Garden Banks NMS
2000	448	18,328	Thunder Bay NMS established
2006	139,818	158,146	Papahānaumokuākea MNM established
2007	33	158,179	Channel Islands NMS expanded
2008	774	158,953	Davidson Seamount added to Monterey Bay NMS
2012	73	159,026	Fagetele Bay NMS expanded and becomes American Samoa NMS
2012	13,507	172,533	Rose Atoll MNM associated with American Samoa NMS
2014	3,852	176,385	Thunder Bay NMS expanded
2015	2,013	178,398	Gulf of Farallones NMS expanded and renamed Greater Farallones NMS
2015	757	179,155	Cordell Bank NMS expanded
2016	440,000	619,155	Papahānaumokuākea MNM expanded
<i>pending</i>	<i>1,059</i>	<i>620,214</i>	<i>Monitor NMS expansion</i>
<i>pending</i>	<i>654</i>	<i>620,868</i>	<i>Flower Garden Banks NMS expansion</i>
<i>pending</i>	<i>1,075</i>	<i>621,943</i>	<i>Great Lakes—Wisconsin NMS designation</i>
<i>pending</i>	<i>46</i>	<i>621,989</i>	<i>Mallows Bay NMS designation</i>

Appendix B—Fleet Service Life Schedule

EXPECTED SERVICE LIFE		SLR SERVICE LIFE REVIEW			# COST OF EVENT (x\$1000)					LIFE EXTENSION PERIOD					END SER. LIFE				
VESSEL	YEAR BUILT	SER. LIFE REVIEW	SER. LIFE EXTENDED	SCHEDULED RETIREMENT	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
R1606	2009	2024	2039	2039								SLR							
Auk	2006	2006	2028	2036							SLR				675				
Safe 25	2003	na	2026	2026												350			
Sand Tiger	2005	2017	2019	2029	SLR		200									8000			
Sam Gray	2004	2021	2026	2031					SLR				53						350
Joe Ferguson	2008	2024	2029	2039								SLR				675			
Parker 1801	1995	2017	2023	2028															
Car. Skiff 2002	1996	2017	2024	2029															
Twin Vee 2204	2008	2028	2035	2040															
Proline 2402	2002	2022	2029	2034															
Mako 2502	1995	2017	2022	2027															
Manta 3007	2001	2021	2028	2033															
Seahunter 2902	2010	2030	2037	2042															
Seahunter 2903	2010	2030	2037	2042															SLR
Sea Vee 3002	2001	2021	2028	2033					SLR						53				
Agassiz	1987	2017	2010	2020	SLR			450											
Carolina Skiff	1997	2018	2025	2030															
Gulfstream	1989	2017	2017	2022															
Dacat	2004	2024	2031	2036															
Proline	2005	2025	2032	2037															
Duskey	2003	2023	2030	2035															
Whaler	1988	2017	2015	2020															
Pathfinder	2001	2021	2028	2033															
Manta 3009	2001	2021	2028	2033															
Manta 3010	2001	2021	2028	2033															
Manta 3008	2002	2022	2029	2034						SLR							53		
Manta 3004	2002	2022	2029	2034						SLR							53		
Rachel Carson	1980	1997	2003	2013															
Peter Gladding	2006	2024	2030	2038								SLR							675
Manta	2007	2021	2025	2033					SLR				1200						
Shark Cat	1987	2017	2009	2019	SLR		350												
Shearwater	2002	2017	2019	2027	SLR	500								4500					
4107	2008	2028	2034	2044													SLR		
Fulmar	2006	2021	2026	2034					SLR				675						
OC-2	1996	2017	2022	2027	SLR				4						25				
Tatoosh	1994	na	2011	2011															
Manuma	2007	2021	2022	2033					SLR	70									
Kohola	2011	2021	2022	2036					SLR	70									
Halalu	2006	2022	2027	2027					SLR						50				
Kaku	2008	2022	2026	2031					SLR					50					250
Malolo	2012	2026	2031	2036									SLR						50
Hihimanu	2007	2022	2027	2032					SLR						70				