

8 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

This section evaluates the environmental consequences of the proposed action of revising the Olympic Coast National Marine Sanctuary (OCNMS) management plan. Because each management plan alternative (described in section 7) is comprised of numerous smaller actions, the term “action(s)” is used in this section not only to reference the overall proposed action of revising the management plan but also to reference the smaller individual actions comprising each alternative.

The environmental effects of the no-action alternative (alternative A), the proposed management plan revision (alternative B-preferred), and alternative C are summarized (Table 13) and then evaluated within the context of the physical, biological, historic and cultural, and human and socioeconomic sanctuary setting. Information about the biological, physical, historic, cultural and socioeconomic sanctuary setting can be found in the Affected Environment discussion (section 6).

Alternative A (no action) includes only non-regulatory actions (i.e., no changes to OCNMS regulations are proposed). Alternatives B and C are comprised of both non-regulatory and regulatory actions (i.e., they include proposed changes to existing OCNMS regulations). Both the regulatory and non-regulatory actions associated with alternatives B and C are analyzed in sections 8.1 through 8.4. Section 8.4 (effects to the historic and cultural setting) serves a dual purpose, fulfilling OCNMS’ compliance requirements both under the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA). Section 8.5 discusses the cumulative effects of the three alternatives within the context of other known activities occurring within the sanctuary region.

Characterizing Effects

NEPA requires consideration of the effects of major federal actions on the quality of the human environment (42 U.S.C. 4332 (c)). Effects are characterized as negligible, less than significant or significant, and are also characterized by type (adverse or beneficial), context, intensity, duration (short- or long-term). Effects can be further characterized by whether they affect resources directly or indirectly. The following definitions and characterizations were used for this analysis:

- **Negligible effects** –effects for which virtually no effect to a resource can be detected (whether beneficial or adverse).
- **Less than significant effects** –effects that do not rise to the level of “significant” as defined below.
- **Significant effects** – effects resulting in an alteration in the health of a physical, biological, historic/cultural or socioeconomic resource. Long-term (see below) or permanent effects with a high intensity of alteration to a resource, whether beneficial or adverse, would be considered significant. The significance threshold is evaluated on a case-by-case basis, taking into consideration the context and intensity of each action. Context normally refers to the setting (e.g., the local and regional status of the resource being affected), and intensity refers to the severity of the effect. Significant effects can be adverse or beneficial, and direct or indirect. Consideration of the accumulation of

Table 13 Summary of analyzed actions

Action	Alternative(s) That Contain This Action	Relevant Action Plans	Effect of Action	Resources Affected
Structural changes to the format of the OCNMS management plan, and revisions to OCNMS goals and objectives	B, C	All 20 Action Plans	Negligible	None
Routine office activities, including meetings, education, visitor and training programs that take place in existing OCNMS or other facilities	A, B, C	All 20 Action Plans	Negligible	None
Use of Information Technology (includes internet technology, data management technology)	A, B, C	All 20 Action Plans	Negligible	None
Routine outreach activities that do not occur in the sanctuary (fair booths, community events)	A, B, C	All 20 Action Plans	Negligible	None
Routine education, outreach and visitor activities	A, B, C	ED, OUT, VISIT, HED, CLIM, MD, WD	Less than Significant, Beneficial, Indirect, Short-term	Biological, Physical, Historic and Cultural, Socioeconomic
Routine research activities	A, B, C	MAP, OCEO, ECO, DATA, SOCIO	Less than Significant, Beneficial, Indirect, Short-term	Biological, Physical, Historic and Cultural, Socioeconomic
Routine maritime heritage activities	A, B, C	MH	Less than Significant, Beneficial, Indirect, Short-term	Historic and Cultural, Socioeconomic
Routine resource protection and stewardship activities	A, B, C	SPILL, MD, CLIM, HP, WQP, ROP, WD	Less than Significant, Beneficial, Indirect, Short-term	Biological, Physical, Historic and Cultural, Socioeconomic
Routine administrative activities (enforcement of regulations and permitting)	A, B, C	CCM, OPS, WD, WQP, HP, MH	Less than Significant, Beneficial, Indirect, Short-term	Biological, Physical, Historic and Cultural, Socioeconomic
Sediment sampling (for habitat mapping and community characterization)	A, B, C	MAP, ECO	Less than Significant, Adverse, Direct, Short-term	Biological, Physical, Historic and Cultural
Operating sonar (for hydrographic surveying)	A, B, C	MAP	Less than Significant, Adverse, Direct, Short-term Less than Significant, Beneficial, Indirect, Long-term	Biological, Physical Historic and Cultural
Anchoring research buoys	A, B, C	OCEO	Less than Significant, Adverse, Direct, Short-term	Biological, Physical, Historic and Cultural

Table 13 (continued) Summary of analyzed actions

Action	Alternative(s) That Contain This Action	Relevant Action Plans	Effect of Action	Resources Affected
Operating vessels in sanctuary	A, B, C	OPS, MAP, OCEO, ECO,	Less than Significant, Adverse, Direct and Indirect, Short-term Less than Significant, Beneficial, Indirect, Short-term	Biological, Physical Socioeconomic
Conducting wildlife research, monitoring and assessments	A, B, C	ECO	Less than Significant, Adverse, Direct, Short-term	Biological
Beach and intertidal activities (student field trips, beach debris removal)	A, B, C	ED, OUT, MD	Less than Significant, Adverse, Direct, Short-term Less than Significant, Beneficial, Indirect, Short-term	Biological, Physical Socioeconomic
Encouraging visitor use of beaches and intertidal areas	A, B, C	VISIT	Less than Significant, Adverse, Direct, Short-term Less than Significant, Beneficial, Indirect, Short-term	Biological, Physical Socioeconomic
Evaluate options to make compliance with the ATBA mandatory	C	SPILL	Less than Significant, Beneficial, Indirect, Long-term Less than Significant, Adverse, Direct, Short-term	Biological, Physical, Socioeconomic
Replace the term "traditional fishing" with "lawful fishing"	B, C	OPS	Negligible	None
Technical clarifications to OCNMS regulations	B, C	OPS	Negligible	None
Modification of the tribal welfare permit provision	B, C	OPS	Negligible	None
Alteration of overflight regulation (reducing overflight floor from 2,000 feet to 1,000 feet)	C	WD	Less than Significant, Adverse, Direct, Long-term	Physical, Socioeconomic
Including a new regulation to ban discharge of invasive species	C	HP	Less than Significant, Beneficial, Indirect, Long-term Less than Significant, Adverse, Direct, Long-term	Biological, Physical Socioeconomic

Table 13 (continued) Summary of analyzed actions

Action	Alternative(s) That Contain This Action	Relevant Action Plans	Effect of Action	Resources Affected
Expanding discharge regulation to include ban on cruise ship discharge	B, C	WQP	Less than Significant, Beneficial, Indirect, Long-term	Biological, Physical
Expanding discharge regulation to include ban on large vessel discharges	C	WQP	Less than Significant, Beneficial, Direct, Long-term Less than Significant, Adverse, Direct, Short-term	Socioeconomic Biological, Physical, Socioeconomic

several individually less than significant effects could result in a determination of significance for cumulative effects.

- **Adverse effects** – effects negatively affecting the health of a resource.
- **Beneficial effects** – effects positively affecting the health of a resource.
- **Short-term effects** – effects lasting one year or less.
- **Long-term effects** – effects lasting longer than one year and/or potentially permanent.
- **Direct effects** – effects occurring at the same time and place as the action.
- **Indirect effects** – effects occurring later in time or farther removed from the place where the action occurs, but reasonably foreseeable.
- **Cumulative effects** – effects resulting from the incremental impact of an action when added to other actions in the past, present, or foreseeable future, regardless of who undertakes such action.

Analysis of the environmental consequences of the three alternatives is based largely on review of existing literature and studies, information provided by experts, and best professional judgment. Environmental consequences of the proposed actions are considered within the context of the revised management plan's five to ten-year planning horizon. Thus, when assessing the effects of an action, the action is presumed to occur for, at most, ten years. In instances where the duration of effects for a specific action potentially repeated within the five- to ten-year planning horizon may be longer than one year, the effects of the action(s) are analyzed as long-term and cumulative effects.

Action Plan (AP) Abbreviations:

CCM – Collaborative and Coordinated Management AP
 COM – Community Involvement in Sanctuary Management AP
 OPS – Sanctuary Operations AP
 MAP – Habitat Mapping and Classification AP
 OCEO – Physical and Chemical Oceanography AP
 ECO – Populations, Communities and Ecosystems AP
 DAT – Data Management, Sharing and Reporting AP
 ED – K-12 Education AP
 HED – Higher Education AP
 VISIT – Visitor Services AP
 OUT – Community Outreach AP
 SPILL – Spills Prevention, Preparedness, Response and Restoration AP
 CLIM – Climate Change AP
 MD – Marine Debris AP
 WD – Wildlife Disturbance AP
 WQP – Water Quality Protection AP
 HP – Habitat Protection AP
 ROP – Regional Ocean Planning AP
 MH – Maritime Heritage AP
 SOCIO – Socioeconomic Values of Resources in the Sanctuary

8.1 PHYSICAL SETTING

The purpose of this section is to discuss the effects of all three alternatives on physical resources in the sanctuary. An overview of the sanctuary's physical setting and the resources encompassed within it is provided in the Affected Environment discussion (section 6.1).

8.1.1 Actions with Negligible Effects to the Physical Setting

There are several actions that would occur under all three alternatives expected to have a negligible effect on the physical setting. These actions include:

- Structural changes to the format of the OCNMS management plan, and revisions to OCNMS goals and objectives
- Routine office and classroom activities, including meetings, visitor, education and training programs taking place in existing OCNMS or other facilities
- Use of Information Technology resources, including internet technology, data management programs, phone and e-mail technology
- Routine outreach activities not occurring in the sanctuary, including staffing fair booths and attending community events
- Routine maritime heritage activities
- Conducting wildlife research, monitoring and assessments

These actions are expected to have a negligible effect on physical resources because these actions all occur within existing facilities, or no construction or physical development is anticipated to be required to conduct these actions. Additionally, these actions would not involve any direct or indirect interaction between the people and physical resources within the sanctuary.

Another action proposed under alternatives B and C involves modifications to OCNMS regulations and also would have negligible effects on physical resources:

- Replace the term “traditional fishing” with “lawful fishing”
- Modifications to the tribal welfare permit provision in the OCNMS regulations
- Technical clarifications to OCNMS regulations as outlined in the Sanctuary Operations Action Plan (strategy OPS 9, activity H)

The current OCNMS regulations define the term “traditional fishing” as “using a fishing method that has been used in the sanctuary before the effective date of sanctuary designation (July 22, 1994), including the retrieval of fishing gear” and provide an exception for traditional fishing operations to three of the regulatory prohibitions – prohibitions on discharge of certain fishing-related materials, disturbance to historical resources and disturbance to the seabed. OCNMS regulations could be interpreted to mean fishing methods or operations not falling within the definition of “traditional fishing” are not allowed to discharge materials mentioned above, or disturb historical resources or the seabed. The precise language of these three exceptions is as follows:

- “Discharging or depositing, from within the boundary of the Sanctuary, any material or other matter except... fish, fish parts, chumming materials or bait used in or resulting from *traditional fishing* operations in the Sanctuary.” (15 CFR 922.152(2)(i))
- “Moving, removing or injuring, or attempting to move, remove or injure, a Sanctuary historical resource. This prohibition does not apply to moving, removing or injury resulting incidentally from *traditional fishing* operations.” (15 CFR 922.152(3))
- “Drilling into, dredging or otherwise altering the seabed of the Sanctuary; or constructing, placing or abandoning any structure, material or other matter on the seabed of the Sanctuary, except as an incidental result of... *Traditional fishing* operations.” (15 CFR 922.152(4)(ii))

As part of this action, NOAA is replacing the term “traditional fishing” with the term “lawful fishing” in these three places to: 1) use a term that is more clearly understood; and 2) eliminate the distinction between fishing methods used before OCNMS designation from those that have since been authorized. Despite the definition provided in the current OCNMS regulations, and because of its varied connotation, the term “traditional” in OCNMS regulations may be incorrectly interpreted (e.g., equating traditional fishing with Native American fishing techniques). Additionally, there is ambiguity associated with the extent of gear modification or uniqueness of design or practice constituting a new or non-traditional fishing method. By replacing the word “traditional” with “lawful” NOAA would unambiguously recognize fishing activities authorized by governmental fisheries management authorities. This change would also be consistent with terms used in the regulations for other national marine sanctuaries on the West Coast.

In recent decades, findings of overfishing and habitat damage from fisheries in U.S. waters have led to gear modifications, mandated stock rebuilding plans, and emergence of an ecosystem approach to fishery management. Before they are authorized, new fishing techniques, gear modifications, or targeted species proposed to federal, tribal and state authorities are evaluated for habitat and ecosystem impacts. This work occurs on a regular basis. While many of the new fishery practices (e.g. gear modifications, rebuilding measures, etc.) are anticipated to have fewer impacts to sanctuary resources, it is possible that a new, lawful fishery or fishery practice may have a negative impact on sanctuary resources (e.g., a test fishery that has unanticipated impacts). In such cases, the proper way to address any concerns related to potential new fisheries or fishing methods within the sanctuary would be through the interagency consultation process pursuant to Section 304(d) of the NMSA (16 U.S.C. 1434(d)).

This change is expected to have a negligible effect because Federal, state, tribal and regional fishery management authorities currently analyze and attempt to mitigate impacts associated with lawful fishing, including fisheries that have occurred traditionally in the sanctuary, and those authorities are expected to do the same in the future. Since the scope and impacts of any such future management actions are speculative at this point, it is not possible, and would be inappropriate, to speculate on any additional impact analysis of this change in this document.

Additional changes to OCNMS regulations identified in strategy OPS 9, activity H would not affect the physical resources within the sanctuary because the changes are language clarifications that do not alter the meaning or intent of the regulations.

Under the current regulations, ONMS can issue a permit to conduct an activity that would otherwise be prohibited if it finds that the activity will meet criteria identified in the regulations. The first criterion is the requirement that NOAA finds that the activity will not substantially injure Sanctuary resources and qualities. The second criterion is related to the purpose of the proposed activity. One of these purposes is the promotion of the welfare of any Indian tribe adjacent to the sanctuary. This provision is ambiguous and could be interpreted as allowing an entity not affiliated with a tribe to apply for a permit that it alleges could promote the welfare of an Indian tribe adjacent to the sanctuary. The concept of “promote the welfare of any Indian tribe” is not defined or explained further in the regulations, the terms of sanctuary designation, or the 1993 Final EIS. In the proposed rule (76 FR 2611), NOAA had further clarified the regulation by replacing the phrase “to promote the welfare of any Indian tribe adjacent to the Sanctuary” with “to promote or enhance tribal self-determination, tribal government functions, the exercise of treaty rights or tribal economic development.”

Based on government-to-government consultations with the Makah Tribe, NOAA has made further changes to the rule modification. NOAA clarified the ambiguity created by the proposed rule (76 FR 2611), making clear that either a Coastal Treaty Tribe (i.e. Hoh, Makah, and Quileute Indian Tribes and the Quinault Indian Nation) or its designee may apply for or be a co-applicant for a permit to promote or enhance tribal self-determination. The final rule language further clarifies that the governing body of the tribe must certify the tribal designee as applicant or co-applicant for a permit, but the tribe need not itself be the applicant or co-applicant. It is not the intent of this language to limit the persons or entities who may apply for a permit under this provision or to require an agency relationship between a tribe and its designee. Rather, it is the intent of this language to create a procedure for the OCNMS Superintendent to be assured that at least one person or entity among the co-applicants, or the applicant itself, has been formally designated by the tribe to apply for the permit as a means to advance the interests of the tribe. Certification from the governing body of the tribe that the person or entity, whether an applicant or co-applicant, has been formally designated by the tribe to apply for the permit could be provided in various forms, the most obvious of which is a resolution adopted by the governing body of the tribe. There may be other forms of providing the official position of the tribal government depending upon the procedures and processes of each tribe.

Modifications to the tribal welfare permit are expected to have a negligible effect on OCNMS’ physical setting. The modifications being made were developed through consultation with the Olympic Coast Intergovernmental Policy Council and the Coastal Treaty Tribes. The goal of the modifications is to clarify the role of the tribal welfare permit, more properly referred to as the “tribal self-determination permit”, and the circumstances under which it can be issued. These clarifications ensure that these permits will only be issued under appropriate circumstances and also ensure that inappropriate uses of the permit are avoided (e.g., cases wherein an organization not affiliated or working with a tribe attempts to obtain a tribal welfare permit by claiming some benefit to a tribe). By modifying the tribal welfare permit language, ONMS is clarifying the intent of its regulations to ensure it is used to promote or enhance tribal self-determination and not to be used by outside parties. Because this regulatory change does not alter the availability of this permit category to American Indian tribes adjacent to the sanctuary, nor change the requirement that the permitted activity will not substantially injure Sanctuary resources and qualities, this modification to the permitting regulations is expected to have a negligible effect on the physical setting.

Alternatives B and C also contain some structural changes to the management plan not included in alternative A. Under alternatives B and C, the management plan would contain performance measures, cost estimates and an implementation table. Alternatives B and C would also include a revised suite of goals and objectives for OCNMS. While these structural modifications do provide additional clarity and detail to the alternatives, they would have a negligible effect on physical resources in the sanctuary.

8.1.2 Actions with Beneficial Effects to the Physical Setting

There are several actions occurring under one or more of the alternatives expected to have a beneficial effect on physical resources within the sanctuary. These actions include:

- Routine activities conducted as part of OCNMS' resource protection, research, visitor services, outreach, education and administrative program areas (alternatives A, B and C)
- A regulatory ban on discharges from cruise ships (alternatives B and C)
- A regulatory ban on discharges from large vessels (alternative C)
- Evaluate (and possibly implement) options to make compliance with the Area-to-be-Avoided mandatory (alternative C)
- A regulatory ban on the discharge of invasive species (alternative C)

8.1.2.1 Routine Activities – Effects to the Physical Setting

Many of the routine and general education, outreach, research, resource protection, administrative, and visitor services actions taking place under all three alternatives would have an indirect, short-term, and less than significant, beneficial effect on physical resources within the sanctuary. These routine actions involve the continuation of OCNMS' primary program areas, including:

- Routine resource protection activities (e.g., marine debris removal)
- Routine research activities (e.g., water quality monitoring)
- Operating sonar for hydrographic surveying
- Routine outreach activities (e.g., citizen science programs)
- Routine education activities (e.g., phytoplankton identification classes)
- Routine visitor services activities (e.g., operating Olympic Coast Discovery Center)
- Routine administrative activities (e.g., enforcement of regulations and permitting)

These routine activities are described in greater detail in the 20 action plans presented in section 5. All of these program areas have less than significant, indirect, and beneficial effects on physical resources because they promote ocean literacy, improved understanding and protection of resources, and improved ocean stewardship. By expanding our knowledge base and promoting ocean stewardship principles with partners, local communities and the general public, ONMS has the opportunity to influence the behavior and decision-making of individuals, communities, organizations and agencies in ways that could indirectly benefit physical resources. For example, if a citizen visits an OCNMS fair booth and learns about the importance of marine debris removal, s/he may be more likely to participate in a beach clean-up activity. In turn, increased participation in beach clean-ups could result in less trash on the beach.

While all of these routine actions are beneficial, it is not expected their effects would be significant because the anticipated intensity of effects associated with these actions is low. Thus, it is not likely a significant improvement in physical resources could be achieved as a result of these types of indirect beneficial actions over the five to ten year implementation period for the management plan.

8.1.2.2 Cruise Ship Wastewater Discharges – Effects to the Physical Setting

Under alternative A, no regulatory modifications are proposed and no additional beneficial effect to the physical setting would be expected. Alternative B proposes a regulatory ban on all discharges within OCNMS from cruise ships (except clean vessel deck wash down, clean vessel engine cooling water, clean vessel generator cooling water, clean bilge water or anchor wash) that would have a direct, long-term, beneficial, less-than-significant impact on physical resources (i.e., water quality) because it would prohibit potentially harmful discharges by introduction of pollutants, such as bacteria, viruses, solids, pharmaceuticals, organics, nutrients, and metals. This regulatory change is discussed in the Water Quality Action Plan in section 5.2. For the purpose of this regulation and consistency with regulations for other West Coast national marine sanctuaries, cruise ships are considered to be vessels with 250 or more passenger berths for hire.

Cruise ships generate a variety of wastewater discharges on the scale of a small municipality with potential, particularly if discharged without treatment, to harm the marine environment. The discharges of highest concern in OCNMS based on volume and potential contaminant loading are sewage, graywater, and bilge water. Sewage discharges from ships, particularly those not using Advanced Water Treatment Systems (AWTS), contain nutrients that create biological and chemical oxygen demand and could contribute to algae blooms that, in turn, could intensify low dissolved oxygen levels known to occur in the sanctuary. Pathogens from sewage have the potential to contaminate commercial or recreational shellfish beds (a human health risk) and to harm wildlife and humans directly.

Properly functioning marine sanitation devices (MSDs; described in section 6.1.3 and Appendix K) decrease nutrient concentrations in sewage through chemical or biological or other treatment technologies. Current federal regulations require all cruise ships treat sewage wastes using a Type II MSD. An initial study conducted in 2000 in Alaska of cruise ship waste water discharges showed high rates of failure in the ability of conventional MSDs to meet legal discharge standards (EPA 2008a). Most cruise ships that transit through OCNMS operate in Alaskan waters. Since this study, significant improvements in treatment and monitoring have been implemented in some vessels supporting Alaska-Washington routes. AWTS have been installed on about 60% of cruise ships transiting through OCNMS. Routine monitoring of these systems has been implemented on vessels discharging to Alaska waters, and these systems have generally performed well at treating effluent monitored by Alaska Department of Environmental Conservation and the US Coast Guard since 2001 (ADEC 2010a). Monitored parameters include fecal coliform bacteria (an indicator of potential pathogens), pH, chlorine, biological oxygen demand, total suspended solids and other chemical constituents. In 2009, exceedance of discharge standards applied to cruise ships occurred most commonly with ammonia, less frequently for nickel, copper and zinc, and rarely or never for other tested contaminants (ADEC 2010a). However, some of the installed AWTS have experienced equipment and operating challenges, and are not being used; traditional (Type II) MSDs are used instead. For vessels approved to discharge in Washington State waters per the NWCCA MOU, they have the ability

and procedures to automatically shut down if continuous monitoring of treated effluent indicates high turbidity or a disinfection system upset. When upsets or failures happen, there is a short lag time between when the upset occurs, the system acknowledges it and the discharge is stopped, which allows a period when ineffectively treated effluents are discharged (Amy Jankowaic, WDE, personal communication).

In general, the dynamic physical, chemical and biological interactions that occur within marine ecosystems are not precisely understood, which makes it difficult to determine the amount of contaminant loading a system can tolerate, under differing naturally variable conditions, without upsetting what may be a delicate natural balance supporting a “healthy” ecosystem. Naturally low availability of nutrients in summer months may limit primary productivity in areas off the Washington coast (Partridge 2007), and significant nutrient inputs, such as nitrogen in ammonia, during summer months could have ecosystem-level effects through alteration of natural primary production cycles. In northern waters of the sanctuary, the Juan de Fuca Eddy is an area of high primary productivity, as well as an initiating location for harmful algal blooms impacting the Washington coast. This eddy lies off the western entrance to the Strait of Juan de Fuca where large vessel traffic is most concentrated due to the ATBA and vessel traffic lanes (Figures 8 and 11). The only opportunity for cruise ship discharges into sanctuary waters occurs in this area, and vessels could focus discharge in this portion of the sanctuary immediately before entering Washington state waters where discharges are limited by the VGP and NWCCA MOU. Even with rapid dilution that occurs while vessels are in transit, increased supply of nutrients to the Juan de Fuca Eddy area, with its retentive circulation pattern, could stimulate plankton growth and enhance initiation of harmful algal bloom events. Moreover, transfer of organic materials generated via algal blooms toward the seafloor and subsequent decay can lead to depletion of dissolved oxygen (DO) in deep waters creating hypoxic (low DO) conditions, which can stress or kill organisms such as invertebrates and fish. Because cruise ship traffic through the sanctuary is highest in summer months when initiation of harmful algal blooms and low oxygen conditions are most prevalent, there is cause for concern about intensification of these phenomena given the volume of nutrient rich wastewaters potentially discharged by cruise ships.

Another water quality concern is discharges from properly functioning MSDs also can contain high concentrations of formaldehyde or chlorine (which are typically used as sterilizing agents) and other chemicals from ship activities, including cleaning chemicals. Although they serve to reduce the pathogenicity of discharges, these chemicals themselves pose a threat to water quality (NOAA 2008). Other than chlorine, there is limited analytical data on such chemical parameters in effluents. Given these complexities, it is difficult to determine the degree to which wastewater discharges from cruise ships are or have potential to be compromising water quality of the sanctuary.

Graywater discharges, including water from galley, laundry and baths or showers, also have potential to degrade water quality. EPA (2008a) evaluated graywater discharges from various sources on cruise ships and compared the concentrations of a wide range of constituents to untreated domestic wastewater or sewage. Most graywater discharges from cruise ships had constituent levels in a similar range to untreated domestic waste water, yet levels for nutrients, biological oxygen demand, and fecal coliforms were many times higher than typical domestic graywater. Nutrients in graywater could negatively impact water quality in the same manner and in combination with discharges of treated sewage from cruise ships. At least 3 of the cruise ships

that transit the sanctuary have no graywater treatment system, and they constitute over 30% of transits in 2010 and 25% of the transits scheduled for 2011 (WDE 2011)

Discharge of bilge water from cruise ships has the potential to introduce oils, detergents, degreasers, solvents and other harmful chemicals into the marine environment that can harm water quality and generate oxygen demand.

Analysis of time in OCNMS and wastewater generation rates indicates a worst-case potential for an estimated 0.2 to 1.3 million gallons of treated sewage and 1.5 to 5.0 million gallons of graywater (either untreated or treated) to have been discharged by cruise ships (passenger vessels >1,600 GT) into the sanctuary in 2009 (Table 6 and Table 7). As discussed in section 8.4.2.2, the volume of wastewater actually discharged from cruise ships in the sanctuary is uncertain. Moreover, the nutrient and chemical concentrations in both untreated and treated wastewater varies depending on the waste streams and performance of wastewater treatment system used. Thus, it is difficult to quantify specific reductions in individual nutrients or chemicals that would be achieved under any proposed alternative. While industry representatives have stated cruise ships currently avoid all discharges in the sanctuary, this has not been verified. Under alternative B, all sewage, graywater, bilge and ballast water discharges would be prohibited from cruise ships (except clean vessel deck wash down, clean vessel engine cooling water, clean vessel generator cooling water, clean bilge water or anchor wash), and potential water quality impacts from these discharges would be eliminated.

The water quality of the sanctuary is generally considered to be good and influenced primarily by natural processes (ONMS 2008). Implementing alternative B would result in less than significant improvement of water quality over the next 10 years. Elimination of nutrient contributions from cruise ship discharges would ensure water quality conditions are not degraded by the inputs of additional nutrients, chemical contaminants, and biological and chemical oxygen demand associated with these wastewater discharges.

As discussed in section 6.1.3.1, ballast water discharges within the OCNMS have the potential to introduce potentially harmful invasive species. Although alternative B would ban ballast water discharges from cruise ships operating in the sanctuary, this aspect of alternative B could have negligible effects on water quality because the U.S. federal, Washington and Canadian rules currently prohibit all ballast water discharges in OCNMS except for ballast water that was exchanged more than 50 nmi from shore. Open ocean ballast water provides a significantly reduced risk of introduced species.

Discharge of any bilge water other than clean bilge water from cruise ships would also be prohibited under alternative B. Untreated bilge water discharges can harm water quality and the marine environment through the introduction of oils, solvents, and other harmful chemicals, with oils being the contaminant of most consistent concern. Because OCNMS regulations currently ban oily bilge water discharges, limiting bilge water discharges from cruise ships to clean bilge water (i.e., treated bilge water that does not leave a visible sheen) would have little to no impact because the standing and final regulations are consistent.

8.1.2.3 Wastewater Discharges from Vessels over 300 Gross Tons – Effects to the Physical Setting

Under alternative C, wastewater discharges from large vessels over 300 gross tons (GT) would be banned (except clean vessel engine cooling water, clean vessel generator cooling water, clean bilge water, anchor wash), in addition to prohibitions on discharges from cruise ships proposed in alternative B. Thus, alternative C encompasses a greater range of vessel classes but does not regulate any additional types of discharges beyond those covered in alternative B. OCNMS regulations under both alternatives B and C would eliminate discharge of all ballast water in OCNMS from cruise ships and large vessels even if an open ocean exchange had occurred. These regulations also might alter the quality of bilge water discharged in the OCNMS as existing OCNMS regulations allow discharge of bilge water that does not include “oily waste”, and new regulations would allow discharge only of “clean bilge water”, which is interpreted to mean treated bilgewater that does not leave a visible sheen and can be considered more restrictive than the existing OCNMS regulatory language.

It is estimated the more inclusive discharge ban proposed under alternative C could result in a potential reduction of sewage discharges of roughly 74%, a 11% reduction (by volume) over alternative B (Table 14). Under Alternative C, graywater discharges could potentially be reduced by 88%, a 13% reduction over alternative B (Table 14). The same beneficial effects expected by implementing alternative B (discussed above) would be realized under alternative C. Due to reduced volumes of discharge in the sanctuary, the magnitude of the positive effects could potentially be greater under alternative C than under alternative B. However, alternative C is still expected to have less than significant effects on the overall water quality of OCNMS because the sanctuary’s water quality is already considered good and, given the sanctuary’s large size, the discharge reduction achieved under alternative C would not likely result in a substantial improvement of water quality (i.e., from ‘good’ to ‘excellent’).

8.1.2.4 Area-to-be-Avoided – Effects to the Physical Setting

Currently, the Olympic Coast Area to be Avoided (ATBA) is an International Maritime Organization (IMO) voluntary vessel routing measure for vessels 1,600 gross tons and above. The ATBA has been in place since 1994, and its compliance rate has been high, estimated to be 98.9% in 2009 (WDE 2010). To maintain the high compliance rate, ONMS works with the USCG to notify non-compliant vessels, then send a formal letter requesting vessel owners or operators to adhere to the ATBA in the future.

Under alternatives A and B, the ATBA would remain voluntary and continue to apply to all ships and barges carrying cargoes of oil or hazardous materials and all ships 1,600 gross tons and above solely in transit. It would also apply to additional classes of vessels based on recent legislation. The Coast Guard Authorization Act for Fiscal Years 2010 and 2011 calls on NOAA to work with the USCG to revise the ATBA so existing restrictions apply to additional vessels. This change would apply to vessels between 400 GT and 1,600 GT, other than fishing or research vessels while engaged in fishing or research within the ATBA.

Table 14 Comparison of estimated potential discharges (in gallons) under alternatives A, B and C

Vessel Classification	Alternative A		Alternative B		Alternative C	
	Sewage Discharge Volume (avg)	Graywater Discharge Volume (avg)	Sewage Discharge Volume (avg)	Graywater Discharge Volume (avg)	Sewage Discharge Volume (avg)	Graywater Discharge Volume (avg)
Commercial Fishing Vessel	94,620	422,636	94,620	422,636	94,620*	422,636 *
Charter Fishing Vessel	45,633	not estimated	45,633	not estimated	45,633	not estimated
Recreational Fishing Vessel	108,686	not estimated	108,686	not estimated	108,686	not estimated
Commercial Vessel < 300GT	2,052	9,166	2,052	9,166	2,052	9,166
Commercial Vessel 300-1599 GT	1,782	7,960	1,782	7,960	prohibited	prohibited
Commercial Vessel > 1600 GT	63,045	281,601	63,045	281,601	prohibited	prohibited
Passenger Vessel < 300 GT	3,600	16,080	prohibited	prohibited	3,600	16,080
Passenger Vessel 300-1599 GT	6,000	26,800	prohibited	prohibited	prohibited	prohibited
Passenger Vessel > 1600 GT	630,936	2,818,181	prohibited	prohibited	prohibited	prohibited
Public Vessel < 300 GT	63	281	63	281	63	281
Public Vessel 300-1599 GT	1,248	5,574	1,248	5,574	prohibited	prohibited
Public Vessel > 1600 GT	3,893	17,387	3,893	17,387	prohibited	prohibited
Tank Vessel	32,715	146,127	32,715	146,127	prohibited	prohibited
Tug with tank barge	2,124	9,487	2,124	9,487	2,124	9,487
TOTAL DISCHARGE	996,396	3,761,280	365,460	943,099	256,778	457,650
DECREASE from Status Quo	-	-	630,936	2,818,181	739,619	3,303,629
Percent reduction in potential discharge from Status Quo	0%	0%	63%	75%	74%	88%

* A number of Commercial Fishing Vessels transiting the sanctuary are > 300 GT and would also be affected by Alternative C. These are not included because the data used in the analysis does not provide tonnage.

Thus, under alternatives A and B, the ATBA is expected to continue to have a less than significant, beneficial, indirect, long-term effect on physical resources by keeping ships posing a spill risk (i.e., potentially large-scale shoreline impacts of a fuel or materials spill) further offshore. The effect is considered less than significant because, while it reduces the risk of a spill occurring in the sanctuary and increases the response time between a spill and when oil would impact the shore, the ATBA does not directly prevent spills from occurring. Another impact of vessel traffic on the physical environment, underwater noise, also is not addressed under alternatives A and B. Effects of vessel noise (and effects of noise pollution, in general) are discussed in section 8.5, Cumulative Effects.

Under alternative C, ONMS would work with its partners to evaluate options to make compliance with the ATBA mandatory. Mandatory ATBA compliance could have an additional beneficial effect (beyond alternatives A and B) on physical resources.

In order to understand the extent and potential significance of this beneficial effect, ONMS evaluated ATBA compliance rates and identified the population of vessels not voluntarily complying with the ATBA. ONMS further evaluated responses from the ATBA Monitoring and Outreach program to evaluate response from the industry on reasons for non-compliance.

The transits of vessels for which the ATBA applied off the Olympic Coast in 2009 are summarized in Table 15. In 2009, 8,849 transits (vessels for which the ATBA applies) were tracked by CVTS monitoring, which extends south to approximately 48 degrees North. Of these transits, 6,128 entered OCNMS (Figure 11), with a total of 68 transiting within the ATBA (Figure 12). In 2009 the ATBA voluntary compliance rate was estimated at near 99%.

In 2009, there were a total of 68 non-compliant transits, representing 59 different vessels, through OCNMS (Figure 12). This is the population of vessels to which the potential mandatory ATBA provisions would have applied if in effect in 2009. The change from voluntary to mandatory would only increase resource protection to the sanctuary if it results in increased compliance to the ATBA provisions. In 2009, 37 letters were sent to non-compliant vessels, this accounted for 54% of the 68 non-compliant vessels. In some instances tracking data may show a vessel just inside the boundaries of the ATBA, in some of these cases letters are not sent. Of letters sent out in 2009, ONMS received 14 replies from vessel owners or agents. In all but a single case, the responses acknowledged the ATBA incursion, and replied that they had taken action to educate their vessel(s) and committed to future compliance. In the single case where the vessel's master did not agree with the determination that their vessel was in the ATBA, they responded they approached, but did not enter the ATBA. A review of the vessel track shows the vessel entered, but only for a very short period of time. Even in this instance the vessel owners agreed to take action to ensure all the vessels in their fleet would avoid the ATBA in the future.

ONMS has concluded changing the ATBA provisions from voluntary to mandatory would have negligible effects on physical resources in the sanctuary, based on the level of observed cooperation by the maritime community and the lack of documented cases where mariners have elected to ignore the voluntary nature of the ATBA. In addition, modification of the ATBA would require submitting a U.S. government proposal to the Marine Safety Committee of the IMO. When considering vessel routing measures used for the purposes of environmental protection, the IMO balances the need for natural resource protection with the protection of

traditional freedoms of navigation. Given the current high rate of compliance, NOAA does not believe a request to change the ATBA from voluntary to mandatory would be favorably received. For these reasons, changing the voluntary nature of the ATBA is not included in OCNMS' preferred alternative.

Table 15 All Cooperative Vessel Traffic Service (CVTS) vessel transits in 2009

Vessel Type	Transits in and out of the Strait of Juan de Fuca recorded by the CVTS ¹	Transits passing through the Sanctuary ²	Transits passing through the ATBA within the Sanctuary ³	Estimated ATBA Compliance Rate ⁴
Articulated Tank Barges	265	257	1	99.6%
Bulk Carriers	2747	1776	19	98.9%
Cable Layers	23	10	0	100.0%
Chemical Tankers	325	240	1	99.6%
Container Ships	2412	1575	15	99.0%
Cruise Ships	450	280	2	99.3%
Fishing Vessels (in transit)	111	81	4	95.0%
General Cargo Ships	487	366	5	98.6%
Heavy Load Carriers	15	14	1	92.9%
Hopper Dredger	2	2	0	100.0%
Liquefied Petroleum Gas Carriers (LPG) and Liquefied Natural Gas (LNG) Carriers	6	3	0	100.0%
Non-oil Tankers	73	57	1	98.2%
Oil Tankers	1056	838	7	99.2%
Ore-Bulk-Oil Vessels (OBO)	12	7	0	100.0%
Refrigerated Ships	6	4	0	100.0%
Roll-on Roll-off Vessels (RORO)	353	201	2	99.0%
Vehicle Carriers	402	323	1	99.7%
Tugs with Chemical Barges	3	3	1	66.7%
Tugs with Oil Barges	101	91	8	91.2%
	8849	6128	68	98.9%

¹ The vessel transits in this column were provided by the CVTS and include commercial vessels greater than 1600 gross tons, or tugs with laden oil or chemical barges.

² This column includes a subset of the CVTS vessel transits through the sanctuary.

³ This column includes a subset of the sanctuary vessel transits that also go through the ATBA. These are vessels potentially not complying with the provisions of the ATBA. These are identified both by CVTS radar and by Seattle Marine Exchange AIS.

⁴ This column shows the percentage of vessels transiting through the Sanctuary that stayed out of the ATBA {Column 4 = 1 - (Column3/Column2)}. This is used as an estimate of compliance with ATBA provisions.

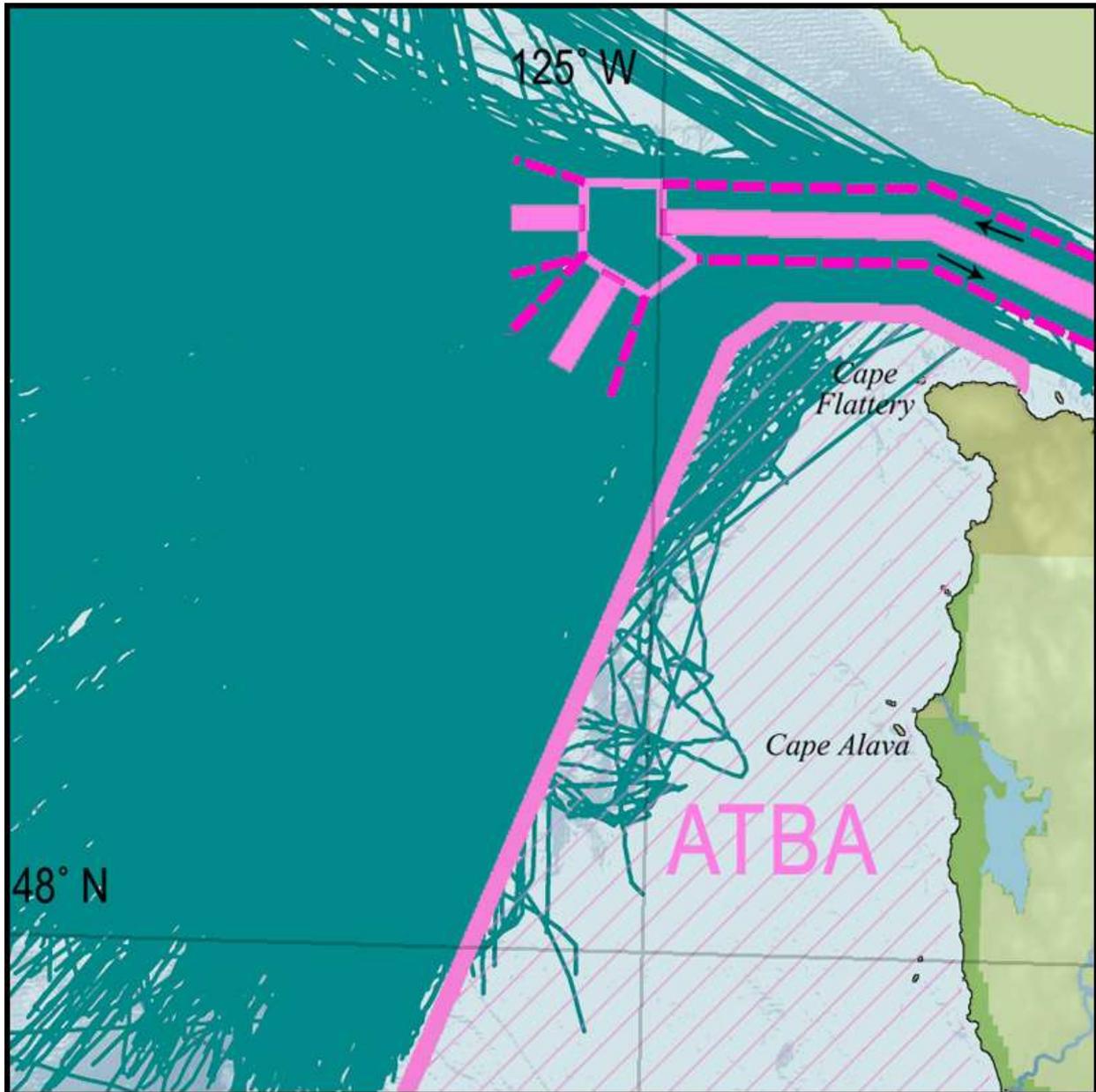


Figure 11 CVTS radar coverage – OCNMS 2009 transit track lines (6,128 transits)

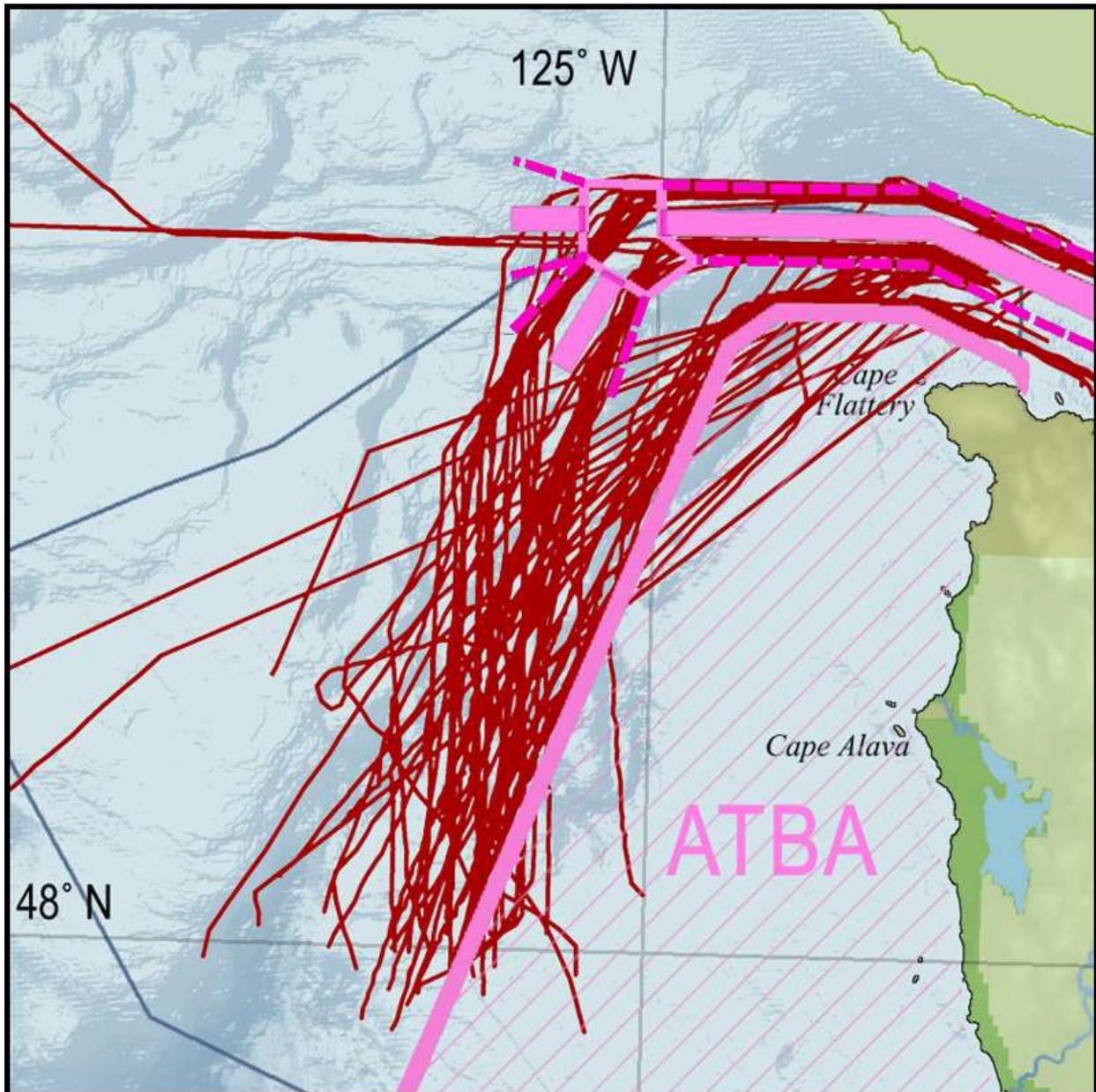


Figure 12 CVTS radar coverage – ATBA 2009 transit track lines (68 transits)

8.1.2.5 Invasive Species Discharge Regulation – Effects to the Physical Setting

Under alternative C, ONMS would establish a new regulation banning the discharge of invasive species in the sanctuary, in addition to conducting a series of non-regulatory actions to address invasive species. Under alternatives A and B, this regulation would not be pursued, and invasive species would be addressed solely through non-regulatory actions (e.g., monitoring).

Banning the direct discharge or release of invasive species in the sanctuary would have a beneficial, long-term effect on physical resources in the sanctuary.

Invasive species can affect physical resources in several ways. Some invasive species, such as certain invasive tunicates, are sedentary for at least part of their lives and affix to substrates, thus altering the physical environment. Invasive species also can affect water quality (e.g., by altering nutrient levels or turbidity). By prohibiting the discharge of invasive species in the sanctuary, ONMS would be complementing and expanding the area addressed by state of Washington regulations developed to prevent the introduction of invasive species into state waters. In most cases, the effects of this new regulation on physical resources would be indirect because the regulation would prohibit discharge of organisms, effects of which would likely occur at locations and times removed from the initial introduction of the organism.

The beneficial effect of this action on physical resources is assumed to be less than significant because the state of Washington already implements ballast water regulations that reduce the risk of invasive species introductions within the sanctuary. Ballast water is a primary invasive species transport vector in marine environments. Over 80 percent of the world's commodities are transported via ships, and these ships result in an annual transfer of an estimated 10 to 12 billion tons of ballast water across the globe (Global Ballast Water Programme 2003). The World Resources Institute estimates 3,000 aquatic species are transported around the globe every day in the ballast water of ships (IMO 2010).

The current Washington state regulations require vessels travelling to Washington from outside of the United States exchange their ballast water at a distance greater than 200 nmi from shore and in waters greater than 2000 meters. Vessels traveling between U.S. ports on the West Coast must exchange ballast water at a distance greater than 50 nmi from shore and in waters at least 200 meters deep. Because the sanctuary, at its widest, extends 40 nmi from shore, no ballast water exchanges should be occurring in the sanctuary.

Thus, it is assumed an OCNMS invasive species discharge ban would have an added beneficial effect primarily on invasive species introductions occurring through vectors other than ballast water. These vectors could include people disposing of exotic aquarium fish or carrying an invasive species on their boats. Current Washington state regulations prohibit release of any classified aquatic nuisance species (lists were developed for the state's administrative code) or any unclassified aquatic species with potential to be a nuisance species. These types of introductions often occur unintentionally and due to a lack of understanding and awareness of invasive species concerns. Thus, an OCNMS regulation prohibiting invasive species introductions alone would complement state regulations but likely not have a significant beneficial effect. It is likely the routine, non-regulatory resource protection activities occurring under all three alternatives and would be focused on invasive species monitoring, education and outreach would be as effective in preventing these types of invasive species introductions (e.g.,

by educating people about the threats posed by invasive species) than would an invasive species regulation.

8.1.3 Actions with Adverse Effects to the Physical Setting

One regulatory change proposed under alternative C could have an adverse effect to the physical setting - reducing the OCNMS overflight regulation from 2,000 feet to 1,000 feet.

Several non-regulatory actions being considered under alternatives A, B and C would result in some adverse effects to physical resources in the sanctuary. Alternative A (i.e., continued management using the 1994 OCNMS management plan) does not define many of these actions with the level of detail provided in alternatives B and C. However, because the original 1994 OCNMS management plan is so broad and general in nature, this analysis assumes any adverse effects associated with these activities would occur under alternative A.

8.1.3.1 Overflight Floor Reduction – Effects to the Physical Setting

A lowering of the overflight floor would not likely alter the number or type of planes flying over the sanctuary, but this regulatory change could affect the physical setting of the sanctuary by increasing the noise detectable and visual impact to visitors to the shoreline adjacent to the sanctuary, much of which is designated wilderness within Olympic National Park. Federal wilderness lands are characterized as areas of undeveloped land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed to preserve its natural conditions, and where the imprint of man's work is substantially unnoticeable and there are outstanding opportunities for solitude. The 2,000 foot FAA advisory that applies to national parks and wildlife refuges mitigates the visual and acoustic impact to wildlife as well as visitors. Based on its effect to the aesthetic value of the ONP wilderness shoreline, this alternative would have an adverse, direct, and long-term effect on physical resources.

8.1.3.2 Seabed Disturbance from Research Activities – Effects to the Physical Setting

Alternatives A, B and C consider research, monitoring and assessment actions related to habitat mapping, and water quality and oceanographic monitoring that may necessitate disturbance of the seafloor in the sanctuary. Seafloor disturbance typically would occur when:

- Anchoring water quality and oceanographic monitoring buoys
- Collecting benthic sediment samples to support habitat mapping and characterization efforts and to identify infaunal communities

In regards to anchoring monitoring buoys, in recent years there have been 13 buoys seasonally deployed by ONMS in the sanctuary. These OCNMS buoys are conducted under the OCNMS Superintendent's Permit that covers activities by OCNMS directly related to management of the sanctuary. Like other permitted activities within the sanctuary, activities conducted under the Superintendent's Permit must not substantially injure sanctuary resources and qualities. There are additional research buoys permitted and installed by other entities in the sanctuary, but the environmental effects of these buoys are evaluated when permit applications to install them are evaluated. The effects of these non-OCNMS buoys are therefore only considered within the context of cumulative effects (section 8.5).

OCNMS buoys are anchored with two steel blocks (120 pounds each; approximately 30cm x 30cm x 10cm) sitting on less than 0.5 m² of seafloor and approximately 2m of iron chain linked to ropes and floats. The adverse effect caused by these weights and chain is direct but less than significant because the anchors are relatively small in size and few in number, so they impact a miniscule percentage of sanctuary seafloor; anchors are deployed on soft rather than rocky seafloor (soft seafloor habitats are more disturbance tolerant and recover more quickly than hard seafloor habitats); moorings have a subsurface float designed to keep chain orientation vertical and off the seafloor; and weights generally remain in place without dragging. The effects are short-term because the anchors are retrieved, and it is expected the habitats where the anchors sit recover relatively quickly (within a year) following this physical disturbance. If the connection to the mooring floats is broken, there is a risk weights could be abandoned, which would cause localized but longer-term effects where the weights sit on the seafloor. This occurs infrequently, and the steel used in the anchors is not acutely toxic to biota.

For habitat characterization work, benthic sediment sampling is performed for each unique benthic habitat type to verify, or ground-truth, and refine interpretations of remotely-collected data. Benthic sediment samples are collected using grab samplers with a footprint impacting less than 0.5 m² of seabed and a physical sample removed from an area 0.1m² or less. Samples are collected at intervals of approximately 2000 meters until that sediment type can be reliably identified with remotely-collected data. In addition, benthic samples from sedimentary areas occasionally are collected from subtidal areas to identify the community of animals living in the sediments. Sampling may affect the seafloor by physical removal of samples (sediment grabs or ROV sampling) or inadvertent contact with the seafloor (video sleds or ROV/AUV equipment).

The adverse effects to the seafloor from benthic sediment sampling are expected to be direct and less than significant because the sampling devices impact a small area of the seafloor (generally 0.5m² or less) in areas of sedimentation (not hard substrate), disturbance is limited to the upper few centimeters of sediment, and sampling is done at wide spatial and temporal intervals, therefore, the intensity of effect is low. The effects of this sediment sampling are short-term given the area impacted and substrates targeted. If seafloor sampling activities inadvertently impacts hard substrate, long-term effects may result if coral/sponge habitat is damaged because this biogenic habitat recovers slowly. However, this is not a planned activity, the damage is not anticipated, and the extent is expected to be de minimis.

Currently, approximately 25% of the OCNMS seafloor has been mapped and characterized. Under alternatives A, B and C habitat mapping and characterization efforts as well as benthic research would continue and efforts may increase (dependent upon resources). Therefore, additional localized, short-term effects to physical resources would be anticipated; however, the intensity of the effects is low as described above. To the extent that the level of effort increases, there is potential for additional adverse effects to physical resources; however, these are less than significant.

8.1.3.3 Operating Vessels in Sanctuary – Effects to the Physical Setting

Several actions being considered under alternatives A, B and C involve the operation of vessels in the sanctuary, which has the potential to cause adverse effects to physical resources. Actions involving the operation of OCNMS vessels (or vessels operating on behalf of OCNMS) include:

- On-water enforcement activities
- Research, monitoring and assessment activities
- Outreach and education activities

OCNMS staff operates a 38', diesel powered research vessel and a rigid-hull inflatable boat. OCNMS research and monitoring projects also involve the use of other NOAA or contracted vessels. OCNMS' RV *Tatoosh* (Figure 13) is occasionally used (no more than five times per year) for training, outreach and education activities (e.g., trips in the sanctuary for OCNMS volunteers). Additionally, the OCNMS vessels are occasionally used to investigate potential regulatory violations (less than five times per year, on average).



Figure 13 OCNMS Research Vessel *Tatoosh*

During a typical calendar year, OCNMS research vessels are operating in the sanctuary about 300 hours total. The exact number of hours varies from year to year based upon funding and operational and vessel repair needs. In some years, non-OCNMS vessels operate in the sanctuary on behalf of OCNMS in order to conduct research or enforcement activities but the number of hours varies considerably from year to year. Vessel operations contribute to temporary, localized noise and air pollution in the sanctuary, may collide with marine life, and pose a risk of hazardous materials spills or of sinking.

The effects of operating OCNMS research vessels in the sanctuary are direct, adverse and less than significant. Vessels are maintained and operated according to rigorous NOAA safety guidelines, have a good safety record, and carry relatively small amounts of hazardous materials. Thus, the risk of a hazardous materials spill or vessel sinking is low. ONMS ensures any research or enforcement vessels operating in the sanctuary on its behalf are maintained and operated by qualified organizations (often other government agencies).

Because OCNMS vessels and those acting on behalf of ONMS operate in the sanctuary an average of a few hundred hours per year, their presence is temporary and use is distributed over a large area, it is expected the effects of noise and air pollution from these activities is less than significant. Noise pollution and the presence of a vessel can alter the physical environment of the sanctuary and cause both direct effects (e.g., distract an organism from its current path) and indirect effects (e.g., alter travel paths in a way that steers organisms away from necessary food sources) to biological resources (discussed in section 8.2). If noise from human activities is elevated to levels considered “pollution” or chronic disturbance, it is more likely to result from the cumulative effect of all the vessels operating in the sanctuary, including the numerous vessels not operating on behalf of OCNMS. The cumulative effects of noise pollution are discussed in section 8.5.

8.1.3.4 Conducting Activities in Intertidal Areas – Effects to the Physical Setting

Alternatives A, B and C also consider actions potentially causing adverse effects to shore and intertidal physical resources. These actions include:

- Beach and intertidal educational and interpretive programs
- Intertidal monitoring surveys
- Marine debris removal projects
- Encouraging visitation to beaches and intertidal areas

OCNMS actions in the intertidal zone are expected to have direct, but less than significant, adverse effects on physical resources. Interpretive efforts that encourage visitation to beaches and intertidal zones can cause trampling. Intertidal educational and interpretive programs typically involve small groups traversing intertidal habitat and can trample invertebrates and algae on rocky surfaces. In intertidal habitats, biological organisms are considered elements of the physical habitat. OCNMS-led intertidal survey teams also can cause trampling damage. Marine debris removal on beaches sponsored by OCNMS and its partners can cause trampling disturbance of intertidal habitats and also result in debris being dragged along the shore, thus causing physical disturbance.

These adverse effects are less than significant because the habitat disturbance occurring is widely distributed in space and time, and generally caused by small groups of people. Therefore, the effects are low intensity and short-term. Moreover, participants in OCNMS stewardship, interpretive, educational and research programs typically are instructed on proper beach etiquette and ways to minimize their impacts on intertidal habitats. The purpose of these actions is to improve ocean literacy, educate people on becoming better stewards of ocean ecosystems, reduce the impacts of marine debris, and improve our understanding of intertidal community ecology – all of which are outcomes beneficially influencing long-term efforts to protect these resources.

The overwhelmingly beneficial effects of these activities outweigh the less than significant, adverse effects that may occur.

8.1.4 Summary of Effects to Physical Setting

In general, the majority of actions being considered under alternatives A, B and C would have a primarily beneficial, less than significant effect on physical resources in the sanctuary. This is because many of the actions, while important to achieving OCNMS' goals and objectives, are relatively small in scale and are not expected to cause a significant improvement to physical resources over the life of the management plan (five to ten years). There is not a significant difference between the beneficial effects to physical resources of the three alternatives.

Alternative C would have a greater overall beneficial effect on physical resources, due to the several additional actions it considers; but, as discussed above, this effect would not be significant.

Water quality in the sanctuary, according to the 2008 OCNMS Condition Report, is "good". It is unlikely the proposed reductions in discharges would cause a substantial improvement in water quality over the next 10 years. However, reducing wastewater discharges would reduce the risk of water quality impacts associated with wastewater discharges and could alleviate stress on sanctuary ecosystems. Thus, reducing wastewater discharge in the sanctuary could have a less than significant, beneficial effect by helping maintain the high water quality in the sanctuary into the future.

Regarding adverse effects to physical resources, several are associated with the actions being considered under the three alternatives, but none of these adverse effects would be significant. There is not a significant difference between the adverse effects to physical resources of the three alternatives.

8.2 BIOLOGICAL SETTING

8.2.1 Actions with Negligible Effect to Biological Setting

There are several actions occurring under all three alternatives that are expected to have a negligible effect on biological resources within the sanctuary. These actions include:

- Structural changes to the format of the OCNMS management plan, and revisions to the OCNMS goals and objectives
- Routine office and classroom activities, including meetings, visitor, education and training programs that take place in existing OCNMS or other facilities
- Use of Information Technology resources, including internet technology, data management programs, phone and e-mail technology
- Routine outreach activities not occurring in the sanctuary, including staffing fair booths and attending community events
- Routine maritime heritage activities

These actions are expected to have a negligible effect on biological resources for various reasons – they are administrative in nature, occur within existing facilities, do not involve any direct or indirect interaction between the people conducting the actions and biological resources, or no construction or physical development is required to conduct these actions.

There are several actions proposed only under alternatives B and C involving modifications to OCNMS regulations with negligible effects on biological resources. These include:

- Technical clarifications to OCNMS regulations as outlined in the Sanctuary Operations Action Plan (strategy OPS 9, activity H)
- Replace the term “traditional fishing” with “lawful fishing”
- Modifications to the tribal welfare permit provision in the OCNMS regulations
- Reducing the OCNMS overflight regulation from 2,000 feet to 1,000 feet (alternative C)

The technical clarifications to OCNMS regulations would not affect the biological resources within the sanctuary because the changes are language clarifications that do not alter the meaning or intent of the regulations.

The current OCNMS regulations define the term “traditional fishing” as “using a fishing method that has been used in the sanctuary before the effective date of sanctuary designation (July 22, 1994), including the retrieval of fishing gear” and provide an exception for traditional fishing operations to three of the regulatory prohibitions – prohibitions on discharge of certain fishing-related materials, disturbance to historical resources, and disturbance to the seabed. OCNMS regulations could be interpreted to mean that fishing methods or operations that do not fall within the definition of “traditional fishing” are not allowed to discharge materials mentioned above, or disturb historical resources or the seabed.

As part of this action, NOAA is replacing the term “traditional fishing” with the term “lawful fishing” in these three places to: 1) use a more clearly understood term; and 2) eliminate the distinction between fishing methods that were used before OCNMS designation from those that

have since been authorized. By replacing the word “traditional” with “lawful” NOAA would unambiguously recognize fishing activities authorized by governmental fisheries management authorities. This change is expected to have a negligible effect because Federal, state, tribal and regional fishery management authorities currently analyze and attempt to mitigate impacts associated with lawful fishing, including that which has occurred traditionally in the sanctuary, and those authorities are expected to do the same in the future. Since the scope and impacts of any such future management actions are speculative at this point, it is not possible, and would be inappropriate, to speculate on any additional impact analysis in this document. See section 8.1.1 for more discussion on the regulatory change to replace the phrase “traditional fishing” with “lawful fishing”.

Under the current regulations, ONMS can issue a permit to conduct an activity otherwise prohibited if it finds that the activity will meet criteria identified in the regulations. One of the criteria listed for permit issuance is to “promote the welfare of any Indian tribe adjacent to the sanctuary.” This provision is ambiguous and could be interpreted as allowing an entity not affiliated with a tribe to apply for a permit that it alleges could promote the welfare of an Indian tribe adjacent to the sanctuary. By modifying the tribal welfare permit language, ONMS is clarifying the intent of its regulations to ensure it is used to promote or enhance tribal self-determination and not to be used by outside parties. Because this regulatory change does not alter the availability of this permit category to American Indian tribes adjacent to the sanctuary, nor change the requirement that the permitted activity will not substantially injure Sanctuary resources and qualities, this modification to the permitting regulations is expected to have a negligible effect on the biological setting. See section 8.1.1 for more discussion on the regulatory change to clarify the permitting language.

A lowering of the overflight floor from 2,000 feet to 1,000 feet would not affect biological resources because there is evidence wildlife disturbance from overflights occurs primarily at elevations below, but not above, 1,000 feet. Low overflights in OCNMS pose a risk of harmful disturbance to marine mammals and seabirds. Examples of harmful disturbance include movement and evacuation in response to low overflights where the young (pups, chicks, eggs) are crushed during an evacuation or exposed to predation as a consequence of loss of parental protection. Studies of overflights have confirmed low altitude overflights do cause wildlife disturbance, but effects vary with plane type, elevation, flight pattern and wildlife species (Parrish et al. 2005). For example, helicopters tend to cause more disturbance than fixed wing planes; repeated passes cause more disturbance than a single pass. Based on observed disturbance caused by overflights, various authors have recommended a buffer (or distance aircraft should stay from wildlife) ranging from 500 to 5,000 feet, depending on the species under consideration (Parrish et al. 2005). Existing altitude restrictions from various locations for protection of various species from aircraft disturbance range from 500 to 2,000 feet (ONMS 1997).

Wildlife biologists and pilots who regularly conduct surveys off the coast of Washington typically request an OCNMS permit to fly between 600 and 1,000 feet altitude to optimize their capabilities for census and behavioral observations. Because the purpose of these flights is to observe undisturbed wildlife (seabirds and marine mammals) for census counts, disturbance would be counterproductive to their purposes. Their personal observations over several decades of work are that wildlife disturbance does not commonly occur with species found off the Olympic Coast for flights above 1,000 feet. It is assumed a lowering of the overflight floor

to 1,000 feet, as proposed in alternative C, would not increase the number of low altitude (<1,000 feet) flights over the sanctuary, and that flights at or above 1,000 feet do not normally cause observable disturbance to wildlife. Therefore, modification of the OCNMS overflight regulation to 1,000 feet would have negligible effects on biological resources within the sanctuary.

In addition, alternatives B and C also contain some structural changes not included in alternative A. Under alternatives B and C, the management plan would contain performance measures, cost estimates and an implementation table. Alternatives B and C also would include a revised suite of goals and objectives for OCNMS. While these structural changes would have a negligible effect on biological resources, these modifications do provide additional clarity and detail to alternatives B and C.

8.2.2 Actions with Beneficial Effects to the Biological Setting

There are several actions occurring in one or more of the alternatives expected to have a beneficial effect on biological resources within the sanctuary. These actions include:

- Routine activities conducted as part of OCNMS' resource protection, research, visitor services, outreach, education and administrative program areas
- A regulatory ban on cruise ship discharge (alternatives B and C)
- A regulatory ban on discharges from large vessels (alternative C)
- Evaluate (and possibly implement) options to make compliance with the Area-to-be-Avoided mandatory (alternative C)
- A regulatory ban on the discharge of invasive species (alternative C)

8.2.2.1 Routine Activities – Effects to the Biological Setting

Many of the routine and general education, outreach, research, resource protection, administrative and visitor services actions would take place under all three alternatives. These routine actions (detailed throughout the 20 action plans in section 5) involve the continuation of OCNMS' primary program areas, including:

- Routine resource protection activities (e.g., marine debris removal)
- Routine research activities (e.g., intertidal and water quality monitoring)
- Routine outreach activities (e.g., citizen science programs)
- Routine education activities (e.g., teacher training classes)
- Routine visitor services activities (e.g., operating the Olympic Coast Discovery Center)
- Routine administrative activities (e.g., enforcement of regulations and permitting)

All of these program areas have less than significant, short-term, indirect, and beneficial effects on biological resources because they promote ocean literacy, improved understanding and protection of natural resources, and improved ocean stewardship. By promoting these principles with partners, local communities and the general public, OCNMS has the opportunity to influence the behavior and decision-making of individuals, communities, organizations and agencies in ways benefiting biological resources. For example, if a citizen visits an OCNMS fair booth and learns about the importance of marine debris removal, he/she may be more likely to participate in a beach clean-up activity and less likely to dispose of trash in or near the ocean. In

turn, increased participation in beach clean-ups could result, over time, in less trash on the beach, which could result in fewer impacts of marine debris to wildlife.

While all of these routine actions are beneficial, it is not expected their effects would be significant. The expected implementation period of the management plan is no more than 10 years; thus, for the purposes of this analysis, the actions proposed within all three management plan alternatives are not projected to last longer than 10 years. It is not likely a significant improvement in biological resources could be achieved on such a short timeframe as a result of these types of indirect, beneficial actions.

8.2.2.2 Vessel Discharges – Effects to the Biological Setting

Alternatives B and C both contain modifications to OCNMS vessel discharge regulations. Under alternative A, none of these regulatory modifications would be made and thus, no additional beneficial effect to the biological setting would be expected. Alternative B proposes a regulatory ban on discharges from cruise ships, with specific types of clean discharges allowed. Alternative C proposes a ban on discharges from large vessels (over 300 gross tons) along with the same cruise ship discharge ban as Alternative B, with specific types of clean discharges allowed. In addition, alternatives B and C also contain non-regulatory strategies in the Water Quality Protection Action Plan related to reducing impacts from vessel discharges (e.g., work with partners to improve availability of sewage pump-out facilities). Section 8.2.1 reviews the expected effects of these non-regulatory actions on biological resources. It is presumed these non-regulatory activities could take place under alternative A, though alternative A does not identify them explicitly.

By reducing the amount of wastewater being discharged into the sanctuary through regulatory modifications, both alternatives B and C would have a beneficial and long-term effect on biological resources in the sanctuary. The effect would be long-term because the changes to regulations would presumably remain in place for the foreseeable future (i.e., beyond one management plan cycle). The reduction in wastewater discharge volumes potentially achieved under alternatives B and C is documented in detail in section 8.1.2. It is estimated that alternative B potentially could result in wastewater discharge reductions of up to 3.4 million gallons (sewage and graywater combined) from cruise ships per year (Table 14). Alternative C potentially could result in a reduction of up to 4.0 million gallons of wastewater discharged in the sanctuary per year (Table 14). It is important to note estimated reductions in discharge volumes are based on estimated wastewater generation rates for the known time intervals that vessels are in the sanctuary, not on actual practice or knowledge of where wastewaters are discharged.

Sewage and graywater discharges can negatively affect biological resources in a variety of ways. Wastewater can contain harmful bacteria, protozoa, and viruses. These pathogens have the potential to contaminate commercial or recreational shellfish beds (a human health risk) and to harm wildlife and humans directly. Analysis of graywater discharges from cruise ships revealed levels of nutrients, biological oxygen demand and fecal coliforms were many times higher than typical domestic graywater (EPA 2008a). Nutrients and biological oxygen demand in graywater could negatively impact water quality in the same manner and in combination with discharges of treated sewage from cruise ships. Fecal coliforms are an indicator of pathogens. In general, pathogen concentrations are not currently a concern in the sanctuary (ONMS 2008), yet there are

clear indications sea otters have been exposed to pathogens that have compromised the health in sea otter populations off California and elsewhere (Brancato et al. 2009). Pathogens can also affect human health through consumption of contaminated shellfish. Whereas AWTs may be highly effective at reducing bacterial contamination, they may not be as effective in elimination of pharmaceuticals and viruses, and fecal coliforms are not a good indicator of wastewater treatment effectiveness for viruses (WDH 2007). As a result, Washington Department of Health recommended and the NWCCA MOU adopted a provision that no cruise ship discharges will occur within 0.5 nmi of harvested shellfish beds. Prohibiting the introduction of pathogens from cruise ship and large vessel sewage and graywater discharges in a more comprehensive area could help reduce further pathogen exposure and prevent health impacts to humans and wildlife in the sanctuary.

Wastewater discharges from vessels can also indirectly affect biological resources. Wastewater contains nutrients with potential to stimulate algal blooms, including species harmful to humans. Transfer of organic materials generated via algal blooms toward the seafloor and subsequent decay can lead to depletion of dissolved oxygen (DO) in deep waters. Hypoxic (low DO) conditions can stress or kill organisms such as invertebrates and fish. Naturally low availability of nutrients in summer months may limit primary productivity in areas off the Washington coast (Partridge 2007), and significant nutrient inputs during summer months could have ecosystem-level effects through alteration of natural primary production cycles. In northern waters of the sanctuary, the Juan de Fuca Eddy is an area of high primary productivity as well as an initiation area for harmful algal blooms impacting the Washington coast. This eddy lies off the western entrance to the Strait of Juan de Fuca where large vessel traffic is most concentrated due to the ATBA and vessel traffic lanes (Figures 8 and 11). The only opportunity for cruise ship discharges into sanctuary waters occurs in this area, and vessels could focus discharge in this portion of the sanctuary immediately before entering Washington state waters where discharges are limited by the VGP and NWCCA MOU. Even with rapid dilution that occurs while vessels are in transit, increased supply of nutrients to this area, with its retentive circulation pattern, could alter productivity patterns and have ecosystem-level effects on the marine life that benefits from this productivity. In addition, an increased occurrence of harmful algal blooms could impact wildlife and human populations of the area.

While there is a risk wastewater discharges could affect the biological setting, it is difficult to determine what volume or content of wastewater would trigger effects. No significantly adverse effects attributable to wastewater discharge in the sanctuary have been documented, and the 2008 Condition Report rated water quality in the sanctuary as “good” (ONMS 2008). Because the reduction in wastewater discharge that would be achieved under alternatives B and C can be considered relatively small when compared to the total volume of water in the sanctuary (i.e., this wastewater becomes diluted once it is discharged), it is unlikely that this reduction in wastewater discharge would result in a significant improvement in water quality or biological resource health (i.e., an elevation from “good” to “excellent” rating for water quality in future condition reports). Thus, the beneficial effects to biological resources of modifying OCNMS discharge regulations under alternatives B and C would be less than significant. While the effects of changing the vessel discharge regulations under alternatives B and C may not be significant within the context of this NEPA analysis, these regulatory changes are still beneficial to biological resources. The goal of more stringent vessel discharge regulations under alternatives B and C would be a precautionary approach, which is fitting of a marine protected

area designated for its national significance, to reduce overall stress on sanctuary ecosystems, maintain existing good water quality conditions in the sanctuary, and prevent the future degradation of water quality that could occur should wastewater discharge increase in the sanctuary region.

8.2.2.3 Area-to-be-Avoided – Effects to the Biological Setting

Currently, the Olympic Coast Area to be Avoided (ATBA) is an International Maritime Organization (IMO) voluntary vessel routing measure. Under alternatives A and B, it would remain voluntary and continue to apply to all ships and barges carrying cargoes of oil or hazardous materials, and all ships 1,600 gross tons and above solely in transit. It would also apply to additional classes of vessels based on recent legislation. The Coast Guard Authorization Act for Fiscal Years 2010 and 2011 calls on NOAA to work with the USCG to revise the ATBA so existing restrictions apply to additional vessels. This change would apply to vessels between 400 GT and 1,600 GT, other than fishing or research vessels while engaged in fishing or research within the area to be avoided.

Because the ATBA would continue as a monitored, voluntary measure without changes to the existing program, ATBA activities under alternatives A and B are expected to have a less than significant, beneficial, indirect, long-term effect on biological resources by keeping ships further offshore and shifting vessel traffic noise away from the continental shelf and much of the sanctuary. The effect is considered less than significant because, while the ATBA reduces the risk of a spill occurring in the sanctuary, it does not directly prevent spills from occurring and does not eliminate vessel traffic noise from the sanctuary.

Under alternative C, OCNMS would work with its partners to evaluate options to make compliance with the ATBA mandatory. This could have an additional beneficial effect (beyond alternatives A and B) on physical resources.

In order to understand the extent and potential significance of this beneficial effect, OCNMS evaluated ATBA compliance rates and identified the population of vessels not voluntarily complying with the ATBA. OCNMS further evaluated responses from the ATBA Monitoring and Outreach program to evaluate response from industry on reasons for non-compliance. This analysis is discussed in 8.1.2.4.

This analysis concluded changing the ATBA provisions from voluntary to mandatory would have negligible effects on physical resources in the sanctuary, based on the level of observed cooperation by the maritime community and the lack of documented cases where mariners have elected to ignore the voluntary nature of the ATBA. In addition, modification of the ATBA would require submitting a U.S. government proposal to the Marine Safety Committee of the IMO. When considering vessel routing measures used for the purposes of environmental protection the IMO balances the need for natural resource protection with the protection of traditional freedoms of navigation. Given the current high rate of compliance NOAA does not believe a request to change the ATBA from voluntary to mandatory would be favorably received. For these reasons, the ATBA expansion is not included in OCNMS' preferred alternative.

8.2.2.4 Invasive Species Discharge Regulation – Effects to the Biological Setting

Under alternative C, ONMS would establish a new regulation banning the discharge of invasive species in the sanctuary, in addition to conducting a series of non-regulatory actions to address invasive species (detailed in the Habitat Protection Action Plan). Under alternatives A and B, this regulation would not be pursued, and the issue of invasive species would be addressed solely through non-regulatory actions. Section 8.2.2.1 provides analysis of the environmental consequences of these non-regulatory strategies.

Banning the introduction of invasive species in the sanctuary could have a beneficial, long-term, indirect effect on biological resources in the sanctuary. Invasive species can adversely impact other organisms in a number of ways, including outcompeting native species for habitat and food sources; spreading diseases to native species; altering the chemistry or physical structure of the environment in a way that inhibits the growth and health of native species; breeding with native species and thus causing alterations in native species genetics; and/or preying aggressively upon native species and thus causing reductions in native species populations. Different invasive species cause different, often unpredictable, effects in different ecosystems.

By prohibiting the discharge of invasive species in the sanctuary, ONMS would be complementing state of Washington regulations aiming to prevent the introduction of invasive species into state waters. In most cases, the effects on biological resources of this new OCNMS regulation would be indirect because the regulation would prohibit discharge of organisms, effects of which would likely occur at locations and times removed from the initial introduction of the organism.

The beneficial effect of this action on biological resources is assumed to be less than significant because the state of Washington already implements comprehensive ballast water and aquatic nuisance (invasive species) programs that dramatically reduce the risk of invasive species introduction within the sanctuary. Because of Washington state regulations outlined in section 8.1.2.5, no ballast water discharges or exchanges should be occurring in the sanctuary (except of mid-ocean exchanged ballast water), and no release of potentially invasive species should be occurring in state waters within three miles of shore. Because an OCNMS regulation banning discharge of invasive species would not increase protections provided by existing state, federal, and Canadian regulations related to invasive species, this regulation was not included in the preferred management plan alternative (alternative B).

8.2.3 Actions with Adverse Effects to the Biological Setting

Several non-regulatory actions being considered under alternatives A, B and C would result in some adverse effects to biological resources. Alternative A (i.e., continued management using the 1994 OCNMS management plan) does not define these actions in the level of detail provided under alternatives B and C. However, because the original 1994 OCNMS management plan is so broad and general in nature, this analysis assumes the adverse effects discussed below could occur under the alternative A.

8.2.3.1 Conducting Wildlife Research, Assessments and Monitoring – Effects to the Biological Setting

Alternatives A, B and C consider a variety of wildlife research, assessment and monitoring actions in order to collect data on species, community and population status, health and trends. This information is critical to effective ecosystem management decision making by OCNMS and others. Wildlife research, assessments and monitoring actions in the sanctuary (under all three alternatives) could affect biota in the water column, as well as in benthic, intertidal and subtidal habitats.

In many cases, conducting research, assessments and monitoring does not cause any adverse or beneficial effect to biological resources (e.g., using binoculars to count sea otters at a distance of 100 – 200 yards). However, in some cases, actions taken while studying biota can cause direct, adverse impacts such as disturbance, minor injury or death. For example, seafloor habitat studies may require collection of organisms for species identification or age analysis. Flying over marine bird colonies for census purposes can disturb the birds. Research may involve tagging organisms, which causes minor, temporary injury to the organism.

Most wildlife studies in the sanctuary are designed and led by entities other than ONMS. OCNMS personnel assist with these efforts and, when appropriate, issue research permits for studies in the sanctuary. The primary exceptions to this are intertidal monitoring, deep sea coral investigations, and oceanographic monitoring buoys in the sanctuary, all efforts OCNMS staff routinely lead. Adverse effects of these activities are discussed in greater detail below.

When applying for a sanctuary research permit, applicants must document how they will comply with all applicable federal and state laws, such as the Endangered Species Act and the Marine Mammal Protection Act. OCNMS staff reviews permit applications on a case-by-case basis and ensures adequate NEPA analysis (by the applicant or OCNMS) is conducted prior to permit issuance. In all cases, ONMS and its partner agencies ensure wildlife studies are designed to minimize the adverse impacts to biota. Particularly with studies of marine birds and mammals, researchers avoid or minimize wildlife disturbance to the greatest extent possible. In order to get an accurate census, aircraft are operated in a manner minimizing the intensity and duration of disturbance to the animals being studied. Thus, the adverse effects of these actions are assumed to be direct, but less than significant and short-term.

8.2.3.2 Operating Hydrographic Sonar in the Sanctuary – Effects to the Biological Setting

All three alternatives (A, B and C) consider actions utilizing sonar in support of hydrographic surveying (seafloor mapping) of the sanctuary. Hydrographic survey data collection in the sanctuary uses active sonar in varying frequency ranges to map the seafloor. These systems are typically either hull-mounted multibeam or towed side-scan sonar systems. Active sonar devices emit pulses of sound waves that travel through the water, reflect off objects, and return to a receiver on the ship. Recent, comprehensive analyses of impacts of anthropogenic underwater noise on marine mammals (e.g., Southall et al. 2007) address sound sources likely to be more egregious, such as explosions, pile driving, seismic air guns, and military low- and mid-frequency sonar, but do not specifically address of sonar systems used for seafloor mapping.

Anthropogenic underwater sounds can adversely affect marine animals in several ways. Response effects on marine mammals are manifest in behavioral changes, such as alteration of

their foraging, diving or vocalization patterns. More intense sound sources can cause physical damage to marine animals, such as damage to sound receiving tissues.

Evaluation of the potential for hydrographic survey sonar to impact marine animals must consider 1) exposure to the sound waves, 2) ability to detect the sound frequency, and 3) intensity of sound exposure. The echosounders most frequently used for coastal surveys within OCNMS are high-frequency echosounders operating at 100-500 kHz (Table 16). One multibeam system (Reson Seabat 8160) used for mapping deep areas operates at a lower frequency (50 kHz), which is considered high-frequency sonar (i.e., >10 kHz). The Reson 8101 multibeam echosounder is installed on OCNMS' RV *Tatoosh* and the Reson 7125 is installed on Office of Coast Survey launches conducting the majority of multibeam survey work in OCNMS.

Table 16 Echosounder specifications for equipment most commonly used by OCNMS for hydrographic surveys

Echosounder	Frequency (kHz)	Transmit Beam Width Across Track
L-3 Klein 3000 (towed dual frequency side scan sonar)	100/500	40°
Reson 7125 (multibeam sonar)	200/400	150°
Klein 5000 (towed side scan sonar)	455	~
Reson Seabat 7111 (deep water multibeam sonar)	100	150°
Reson Seabat 8101 (deep water multibeam sonar)	240	150°
Reson Seabat 8160 (deep water multibeam sonar)	50	150°
Kongsberg Simrad EM1002 (deep water multibeam sonar)	95	150°

There is a low probability of marine mammal exposure to sonar from a side-scan “fish” because during operation the instruments are towed near the seafloor, typically 10-20 m off the bottom, with sound directed downward. To intersect with a side-scan’s zone of sonification, a marine mammal would have to swim under the side scan “fish” very near the seafloor. Multibeam sonar systems are typically hull mounted and have a wide beam width (Table 16), so their sonar transmits throughout the water column over a sizeable area underneath the survey vessel; therefore, the area of potential exposure is significantly larger for multibeam than with sidescan sonar. Both systems emit relatively low intensity sound in comparison to underwater detonations or military low- and mid-frequency sonar used to traverse long distances under water. High-frequency sonar attenuates through scattering and absorption in water, an effect that increases with sonar frequency. Thus, these higher frequency sonar systems have potential to expose animals to low intensity sound in a limited area between the instrument and the seafloor.

Marine mammals have been categorized into low-, mid-, and high-frequency functional hearing groups (Southall et al. 2007). Mid-frequency cetaceans have an upper limit of sound detection of 160 kHz. High-frequency cetaceans can detect up to 180 kHz. Pinnipeds in water cannot detect sounds above 75 kHz. In a recent and comprehensive analysis of potential impacts to marine mammals of sonar and underwater noises, the U.S. Navy (2010b) did not model impacts of sonar systems operating above 180 kHz because marine mammals have functional hearing ranging from 10 hertz (Hz) to 180 kHz, and they are most sensitive to sound sources well below 180

kHz. Marine fish generally have hearing capability at frequencies of 4 kHz or lower (U.S. Navy 2010b), well below frequencies used for hydrographic surveys.

Because sound generated by hydrographic survey equipment has a low intensity level, occurs over a limited area, attenuates quickly, and is at frequencies out of peak hearing ranges for most marine mammals, the likelihood of adverse effects to marine life is very low.

NOAA continues to refine its understanding of each species' sensitivity to sound with the goal of minimizing adverse effects to marine organisms. ONMS believes its use of sonar in support of hydrographic surveying has a less than significant, short-term, direct adverse effect on organisms (particularly marine mammals) in the sanctuary.

In general, the ocean is becoming a much noisier place and concern about the cumulative effects of underwater noise pollution is increasing. The potential cumulative effects of noise pollution in the sanctuary are discussed in section 8.5.

8.2.3.3 Seabed Disturbance from Research Activities – Effects to the Biological Setting

Alternatives A, B and C consider research, monitoring and assessment actions related to habitat studies and mapping and oceanographic monitoring that may necessitate disturbance of the seafloor in the sanctuary. Because virtually all seafloor substrates in the sanctuary host some living organisms, disturbing the seafloor can adversely affect biological resources. Seafloor disturbance would occur when:

- Anchoring water quality and oceanographic monitoring buoys
- Collecting benthic sediment samples to support habitat mapping and characterization efforts and to identify infaunal communities

Similar to adverse effects to the physical setting, adverse effects to the biological resources caused by buoy anchors are direct but less than significant, for several reasons. The anchors are relatively small in size (Figure 14) and few in number, so they impact a miniscule percentage of sanctuary seafloor. Anchors are deployed on soft rather than rocky seafloor, and soft seafloor habitats are more disturbance tolerant and biological resources there would likely recover more quickly than hard seafloor habitats. Moreover, the anchors generally remain in place without dragging and disturbing a large area of seafloor. Surface dwelling organisms may be crushed when the weights are deployed, and subsurface organisms may be blocked from access to overlying water. Most macrofauna inhabiting seafloor substrate is located in the upper, oxygenated layer of sediment. These effects are short-term because the anchors are retrieved, and it is expected the soft seafloor habitats where the anchoring occurs are repopulated with biological organisms relatively quickly (within a year) following this disturbance. If the connection to the mooring floats is broken, there is a risk that weights could be abandoned, which would cause long-term effects. These effects are less than significant because the area impacted is small, the anchors are constructed of non-toxic materials for the anchor weights, and anchors are lost infrequently.

Similar to adverse effects to the physical setting, the adverse effects to biological resources caused by benthic sediment sampling are expected to be direct and less than significant because the sampling devices impact a small area of the seafloor (generally 0.1m² or less) in areas of sedimentation (not hard substrate), and sampling is conducted at wide spatial and temporal

intervals. The organisms inhabiting the sediment sample normally are collected and analyzed, and they do not survive. While a few organisms may die, the overall populations of these organisms are not likely to be affected adversely because a minuscule area of the seafloor is sampled on an occasional basis.



Figure 14 OCNMS mooring anchor

Collection of sediment samples allows ONMS to refine its habitat mapping and classification methods to rely less on physical sediment sampling in the future. This work also improves understanding of organism distribution relative to different sediment types or areas. The effects of this sediment sampling are short-term given the limited area impacted and types of substrates targeted. If seafloor sampling activities inadvertently impact hard substrate, long-term effects may result – particularly if coral/sponge habitat is damaged because this habitat recovers slowly. However, this is not a planned activity, the damage is not anticipated, and the extent is expected to be de minimis.

8.2.3.4 Operating Vessels in Sanctuary – Effects to the Biological Setting

Several actions being considered under alternatives A, B and C involve the operation of vessels in the sanctuary, which has the potential to cause direct and indirect adverse effects to biological resources. These actions include:

- On-water enforcement activities
- Research, monitoring and assessment activities
- Outreach and education activities

OCNMS vessel operations are described in section 8.1.3. OCNMS vessels contribute to noise and air pollution in the sanctuary, can collide with marine life, and pose a risk of hazardous materials spills or of sinking, all of which could affect biological resources. In addition, operation of vessels has the potential to adversely affect marine life through vessel strikes or disturbance to animals.

The release of hazardous materials from an OCNMS vessel sinking would have the potential to adversely affect the biological environment through compromised water quality. The risk of a hazardous materials spill or vessel sinking is low because these vessels are maintained and operated according to rigorous NOAA safety guidelines, have a good safety record, and carry relatively small amounts of hazardous materials (fuels and fluids). Since OCNMS designation, no OCNMS-owned or contracted vessel has been responsible for a hazardous materials spill.

Noise pollution can cause both direct biological effects (e.g., distract an organism from its current path) and indirect effects (e.g., alter behavior paths in a manner that reduces access to food sources). If noise from human activities is elevated to levels considered “pollution” or chronic disturbance, it is more likely to result from the cumulative effect of all vessels operating in the sanctuary, including the numerous vessels not operating on behalf of ONMS. The cumulative effects of noise pollution are discussed in section 8.5.

Vessel captains operate with sensitivity to avoid disturbance or injury to marine life. Given the relatively small size of OCNMS vessels, vessel captains are acutely concerned about collisions with floating objects (i.e., logs, floats), seabirds (which can be sucked into the engine water intakes or clog the propulsion jets), and marine mammals. On water visibility from OCNMS vessels is excellent, and operations are limited to daylight in moderate seas, which provides better marine mammal sighting conditions. Moreover, vessel captains are trained to watch for marine mammals and seabirds and maneuver the vessel away from them. All of these conditions support a low risk of vessel strikes. The severity of vessel strikes, the conservation status of the species hit and the number of vessel strikes in a given year are all factors influencing the significance of vessels strikes as a potential adverse effect. Twenty-nine species of marine mammal have been sighted in the sanctuary, eight of which are listed on the Endangered Species List. In its 16-year history, no OCNMS owned or contracted vessel has struck a marine mammal or been responsible for a hazardous materials spill.

Because OCNMS vessels and those acting on behalf of OCNMS operate in the sanctuary an average of a few hundred hours per year with operations widely distributed in space and time, it is expected that the effects on biological resources of vessel operations is less than significant. Under all three alternatives, the potential effects of operating OCNMS research vessels on biological resources would be considered less than significant, direct (a vessel strike or fuel spill) and indirect adverse effects on the population of the species affected.

8.2.3.5 Conducting Activities in Intertidal Areas – Effects to the Biological Setting

Alternatives A, B and C also consider actions potentially causing adverse effects to shore and intertidal biological resources. These actions include:

- Beach and intertidal educational and interpretive programs
- Intertidal monitoring surveys
- Marine debris removal projects
- Encouraging visitation to beaches and intertidal areas

Actions in the intertidal zone may have direct, but less than significant, adverse effects on biological resources. Intertidal educational and interpretive programs typically involve small groups traversing intertidal habitat and can trample invertebrates and algae on rocky surfaces. Interpretive efforts encouraging visitation to beaches and intertidal zones can also lead to trampling. Intertidal survey teams also can cause trampling damage. Marine debris removal sponsored by OCNMS and its partners can cause disturbance of intertidal habitats, or result in debris being dragged along the shore, thus causing disturbance.

These adverse effects are less than significant because the disturbance to biological organisms occurring is widely distributed in space and time and generally limited because there are small groups of people. Moreover, participants in OCNMS stewardship, interpretive, educational and research programs generally are instructed on proper beach etiquette and ways to minimize their impacts on intertidal habitats. The purpose of these actions is to improve ocean literacy, educate people on becoming better stewards of ocean ecosystems, reduce the impacts of marine debris, and improve our understanding of intertidal community ecology – all of which are outcomes beneficially influencing long-term efforts to protect these resources. These overwhelmingly beneficial effects of these activities outweigh the minimal adverse effects that may occur.

8.2.4 Summary of Effects to Biological Resources

Within the context of this NEPA analysis, the majority of actions being considered under alternatives A, B and C would have a primarily beneficial, less than significant effect on biological resources in the sanctuary. This is because many of the actions, while important to achieving OCNMS' goals and objectives, are relatively small in scale and are not expected to cause a significant improvement to biological resources over the life of the management plan (five to ten years). There is not a substantive difference in the beneficial effects to biological resources of the three alternatives. Alternative C would have a greater overall beneficial effect on biological resources, due to the several additional regulatory and non-regulatory actions it considers, but this effect would not be significant.

Several adverse effects to biological resources are associated with the actions being considered under the three alternatives, but none of the effects would be significant. There is not a substantive difference between the adverse effects to biological resources of the three alternatives.

8.3 HISTORICAL/CULTURAL SETTING

8.3.1 Actions with Negligible Effect to the Historical/Cultural Setting

There are several actions occurring under all three alternatives expected to have a negligible effect on the historical/cultural setting. These actions include:

- Structural changes to the format of the OCNMS management plan, and revisions to OCNMS goals and objectives
- Routine office and classroom activities, including meetings, visitor, education and training programs that take place in existing OCNMS or other facilities
- Use of Information Technology resources, including internet technology, data management programs, phone and e-mail technology
- Routine outreach activities that do not occur in the sanctuary, including staffing fair booths and attending community events
- Evaluate options to make compliance with the ATBA mandatory
- Including a new regulation to ban discharge of invasive species
- Expanding discharge regulation to include ban on cruise ship discharge
- Expanding discharge regulation to include ban on large vessel discharge
- Operating vessels in sanctuary
- Encouraging visitor use of beaches and intertidal areas
- Routine research activities
- Conducting wildlife research, monitoring and assessments
- Beach and intertidal activities (student field trips, beach debris removal)

These actions are expected to have a negligible effect on the historical/cultural because they involve no direct or indirect interaction between people or equipment and historical/cultural resources, are administrative in nature, occur within existing facilities, or include no construction or physical development. The actions identified above that could potentially occur in the vicinity of historical/cultural resources – research activities, wildlife monitoring, beach/intertidal activities - are conducted by (or under the supervision of) sanctuary staff with sensitivity to their responsibility under the National Historic Preservation Act. Activities involving physical disturbance to the terrestrial or marine substrate are evaluated in advance for proximity to locations in the SHPO's database, and they are not conducted in the immediate vicinity of documented historical/cultural resources. If an undocumented resource is identified or suspected, sanctuary staff would cease operations and consult with the SHPO and THPO before additional disturbance would be allowed. Furthermore, in Strategy MH1 of the management plan OCNMS has identified as a high priority the development of a programmatic agreement that will clarify and formalize procedures for consultation with other historical/cultural resource managers and avoidance of impacts to these resources.

There are several actions proposed under alternatives B and C involving modifications to OCNMS regulations which also have negligible effects on the historical/cultural setting. These include:

- Technical clarifications to OCNMS regulations as outlined in the Sanctuary Operations Action Plan (strategy OPS 9, activity H)

- Replace the term “traditional fishing” with “lawful fishing”
- Modifications to the tribal welfare permit provision in the OCNMS regulations
- Reducing the OCNMS overflight regulation from 2,000 feet to 1,000 feet (alternative C only)

The technical clarifications to OCNMS regulations would not affect historical/cultural resources within the sanctuary because the changes are language clarifications not altering the meaning or intent of the regulations.

The current OCNMS regulations define the term “traditional fishing” as “using a fishing method that has been used in the sanctuary before the effective date of sanctuary designation (July 22, 1994), including the retrieval of fishing gear” and provide an exception for traditional fishing operations to three of the regulatory prohibitions – prohibitions on discharge of certain fishing-related materials, disturbance to historical resources, and disturbance to the seabed. OCNMS regulations could be interpreted to mean that fishing methods or operations that do not fall within the definition of “traditional fishing” are not allowed to discharge materials mentioned above, or disturb historical resources or the seabed.

As part of this action, NOAA proposes to replace the term “traditional fishing” with the term “lawful fishing” in these three places to: 1) use a more clearly understood; and 2) eliminate the distinction between fishing methods used before OCNMS designation from those authorized after designation. By replacing the word “traditional” with “lawful” NOAA would unambiguously recognize fishing activities authorized by governmental fisheries management authorities. This change is expected to have a negligible effect because Federal, state, tribal and regional fishery management authorities currently analyze and attempt to mitigate impacts associated with lawful fishing, including that which has occurred traditionally in the sanctuary, and those authorities are expected to do the same in the future. Since the scope and impacts of any such future management actions are speculative at this point, it is not possible, and would be inappropriate, to speculate on any additional impact analysis in this document. See section 8.1.1 for more discussion on the regulatory change to replace the phrase “traditional fishing” with “lawful fishing”.

Under the current regulations, OCNMS can issue a permit to conduct an activity otherwise prohibited if it finds that the activity will meet criteria identified in the regulations. One of the criteria listed for permit issuance is to “promote the welfare of any Indian tribe adjacent to the sanctuary.” This provision is ambiguous and could be interpreted as allowing an entity not affiliated with a tribe to apply for a permit that it alleges could promote the welfare of an Indian tribe adjacent to the sanctuary. By modifying the tribal welfare permit language, OCNMS is clarifying the intent of its regulations to ensure it is used to promote or enhance tribal self-determination and not to be used by outside parties. Because this regulatory change does not alter the availability of this permit category to American Indian tribes adjacent to the sanctuary, nor change the requirement that the permitted activity will not substantially injure Sanctuary resources and qualities, this modification to the permitting regulations is expected to have a negligible effect on the historical/cultural setting. See section 8.1.1 for more discussion on the regulatory change to clarify the permitting language.

A lowering of the overflight floor from 2,000 feet to 1,000 feet would not affect historical/cultural resources within the sanctuary because this change in regulation would not affect the number or type of aircraft flying over the sanctuary and flights will not have physical interaction with maritime heritage resources.

Finally, alternatives B and C also contain some structural changes to the management plan not included in alternative A. Under alternatives B and C, the management plan would contain performance measures, cost estimates and an implementation table. Alternatives B and C also would include a revised suite of goals and objectives for OCNMS. While these structural modifications to the document would have a negligible effect on the historical/cultural setting, they are important to note because these modifications do provide additional clarity and detail to alternatives B and C.

8.3.2 Actions with Beneficial Effects to the Historical/Cultural Setting

There are several activities occurring in one or more of the alternatives expected to have a beneficial effect on historical/cultural resources within the sanctuary. These actions include:

- Routine education, outreach visitor service, resource protection and administrative program activities
- Operating sonar (for hydrographic surveying)
- Routine maritime heritage activities

8.3.2.1 Routine Education, Outreach, Visitor Services, Resource Protection and Administrative Program Activities – Effects to the Historical/Cultural Setting

Many of the routine education, outreach, visitor services, resource protection and administrative actions taking place under all three alternatives would have an indirect, short-term, and less than significant, beneficial effect on historical/cultural resources within the sanctuary. These routine actions involve the continuation of OCNMS' primary program areas, including:

- Routine resource protection activities (e.g., beach cleanups)
- Routine outreach activities (e.g., public events)
- Routine education activities (e.g., maritime heritage presentations)
- Routine visitor services activities (e.g., operating Olympic Coast Discovery Center)
- Routine administrative activities (e.g., enforcement of regulations and permitting)

All of these program areas have less than significant, indirect and beneficial effects on historical/cultural resources because they promote ocean and cultural resource literacy, improved understanding and protection of heritage resources, and improved ocean stewardship. By promoting these principles with partners, local communities and the general public, OCNMS has the opportunity to influence the behavior and decision-making of individuals, communities, organizations and agencies in ways benefiting historical/cultural resources. For example, if a citizen visits an OCNMS fair booth and learns about the importance of not disturbing archaeological remains, s/he may be more likely to act responsibly near historic/cultural resources. They might also share that perspective with others, which could result in better protection of resources, such as shipwreck remains or shoreline midden sites.

While these routine actions are beneficial, it is not expected their effects would be significant within the context of NEPA. The expected implementation period of the management plan is not expected to be more than 10 years. It is not likely that a substantial improvement in historical/cultural resources could be achieved on such a short timeframe as a result of these types of indirect, beneficial actions.

8.3.2.2 Operating Sonar for Hydrographic Surveying – Effects to the Historical/Cultural Setting

Section 110 of the National Historic Preservation Act (NHPA) directs federal agencies managing public bottomlands to inventory the historical and archaeological resources within the management areas and to assess the significance of those resources for possible inclusion onto the National Register of Historic Places. Under all three alternatives considered, operating sonar for hydrographic surveying would be conducted to identify and map habitats, as well as biological and historical resources. This activity would have a beneficial, indirect, and less than significant effect on historical/cultural resources because they would improve understanding of what historic and cultural resources exist in the sanctuary. Improved understanding of resources alone may not directly affect these resources in a beneficial way. However, subsequent actions resulting from this research, such as listing on the National Register of Historic Places, would benefit the resources in the long term. The beneficial effect of these research activities is expected to be less than significant because there is no assurance that resources will be found or that they can be effectively protected in the harsh sanctuary environment.

8.3.2.3 Routine Maritime Heritage Activities – Effects to the Historical/Cultural Setting

As noted above, Section 110 of the NHPA requires agencies to inventory historical and archaeological properties. ONMS is also directed by the National Marine Sanctuaries Act to comply with the Federal Archaeology Program which includes laws, regulations and guidelines administered by the Department of the Interior. The Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716) recommend the following activities to inventory historical and archaeological properties:

- Identification of the resources through:
 - Archival Research - the OCNMS database contains much of this research
 - Field Survey – beach surveys and remote sensing of submerged sanctuary environment
 - Reporting of Results – results should be reported upon to professional communities and the public
- Evaluation of identified resources to determine the historical significance of the resource
- Registration of significant resources to the National Register of Historic Places and, if appropriate, as a National Historic Landmark

Actions outlined in section 5.2 in Strategy MH1 – Cultural Resource Conservation are expected to have a beneficial effect on historic and cultural resources because they will improve knowledge and understanding of these resources and thus indirectly improve OCNMS' ability to protect and interpret these resources. Additionally, should resources be identified and eligible for the National Register of Historic Places, this designation would provide added protections for the resources. OCNMS expects the effects of these actions on cultural resources to be less than

significant because they consist exclusively of planning and low-impact survey activities for beneficial conservation purposes. As part of the implementation of the final management plan, OCNMS will work with the State Historic Preservation Office (SHPO), Makah Tribal Historical Preservation Office (THPO), and other partners to develop a programmatic agreement under section 106 of the National Historic Preservation Act. This process is likely to provide NOAA with a better understanding of the current status of historic resources within the sanctuary. Should significant historic resources be found in the sanctuary, OCNMS will work with the same partners to develop appropriate management plans for these resources in accordance with NEPA and NHPA.

8.3.3 Actions with Adverse Effects to the Historical/Cultural Setting

Several actions being considered under alternatives A, B and C could result in adverse effects to historical/cultural resources in the sanctuary. These include the following actions that may necessitate disturbance of the seafloor in the sanctuary:

- Anchoring water quality and oceanographic monitoring buoys
- Collecting benthic sediment samples to support habitat mapping and characterization efforts and to identify infaunal communities

These actions are described in section 8.1.3. Both actions have the potential for damaging historical/cultural resources on the seabed. The impacts described in section 8.1.3 (impacts to physical setting) apply here. These activities could cause adverse effects to historic/cultural resources by physically damaging historic resources resting on the seafloor of which OCNMS is unaware. Because these operations impact only the upper few centimeters in a very limited area on the seafloor and the total area subject to these operations is small over a 5- to 10-year period, these effects would be less than significant.

It should be noted these two actions (sediment sampling and anchoring buoys) refer to OCNMS efforts only. It is possible an outside party could apply for an OCNMS permit to conduct sediment sampling, anchor research buoys or conduct some other seafloor disturbance activity in the sanctuary on a scale larger than work conducted by OCNMS. Permit applications of this kind will be analyzed for potential impacts to historic and cultural resources (as well as biological and physical resources). OCNMS might deny or place specific restrictions on a permit in order to ensure the protection of resources (see 8.5 Cumulative Effects, Actions for Future Analysis).

8.3.3.1 Compliance with Section 106 of the NHPA – Effects to the Historical/Cultural Setting

On April 27, 2010, ONMS published a *Federal Register* notice (Appendix B) notifying the public of ONMS' intent to coordinate its responsibilities under Section 106 of NHPA with its ongoing NEPA process, including the use of NEPA documents and public and stakeholder meetings to meet the NHPA Section 106 requirements. Section 8.3 of this document addresses the "Historical/Cultural Setting" and is intended to fulfill NHPA Section 106 requirements for the revised OCNMS management plan. It should be noted that Section 106 of NHPA addresses only historic properties and resources as defined in the NHPA. The analysis in this document encompasses additional cultural resources that are included in order to satisfy NEPA analysis requirements.

In the process of developing this document, ONMS identified consulting parties and requested information about historic properties and resources in the sanctuary to be considered in this impacts analysis. No information was provided by the SHPO, THPO or others during the EA drafting process. Should more information on the effects of revising the management plan on historic resources and properties come to light once the FMP/EA is published, OCNMS will consult with the SHPO and THPO and conduct its operations consistent with NHPA requirements.

8.3.4 Summary of Effects to Historical/Cultural Setting

In general, the majority of actions being considered under alternatives A, B and C would have a primarily beneficial, less than significant effect on historical/cultural resources in the sanctuary. The effects are expected to be less than significant because many of the actions, while important to achieving OCNMS' goals and objectives, are relatively small in scale and are not expected to cause a significant improvement to historical/cultural resources over the life of the management plan (five to ten years). There is not a significant difference between the beneficial effects to historical/cultural resources of the three alternatives.

Regarding adverse effects to historical/cultural resources, some are associated with actions being considered under the three alternatives, but none of these adverse effects would be significant. There is not a significant difference between the adverse effects to historical/cultural resources of the three alternatives.

8.4 HUMAN/SOCIOECONOMIC SETTING

The purpose of this section is to discuss the socioeconomic effects of all three alternatives on human activities. An overview of the sanctuary's human/socioeconomic setting and the activities encompassed within this setting is provided in the Affected Environment discussion.

If the no action alternative (alternative A) were selected, ONMS could choose to implement the non-regulatory aspects of alternatives B and C, which would have unique implications on the human/socioeconomic setting. Because the extensive efforts in collaboration with multiple partners were made through the management plan review process to evaluate OCNMS programs and more clearly define future priorities, an expectation has developed amongst collaborators that most all of the action plans will be implemented. Given the lack of specificity in the current management plan, which represents the no action alternative, it is likely that OCNMS would seek to implement many non-regulatory actions in alternative B under the no action alternative. Yet implementation of these action plans without officially adopting them through revision to the management plan would undermine the trust developed through this process and transparency that ONMS aims to achieve with the management plan review process. Implementing the action plans without incorporating them into an OCNMS management plan would reduce ONMS' accountability and most likely confuse members of the public interested in understanding ONMS' structure and work efforts. Moreover, because the 20 action plans in the FMP do not correspond directly to the structure of the original 1994 management plan, it would be difficult for the public and ONMS partners to understand how the action plans and original management plan relate to one another.

8.4.1 Actions with Negligible Effects to the Human/Socioeconomic Setting

There are several actions occurring under all three alternatives that are expected to have a negligible effect on the human/socioeconomic setting within or around the sanctuary. These actions include:

- Structural changes to the format of the OCNMS management plan, and revisions to OCNMS goals and objectives
- Routine office and classroom activities, including meetings, visitor, education and training programs that take place in existing OCNMS or other facilities
- Use of Information Technology resources, including internet technology, data management programs, phone and e-mail technology
- Routine outreach activities that do not occur in the sanctuary, including staffing fair booths and attending community events

None of these actions would have a direct impact on human activities within the sanctuary. These actions are either administrative in nature or do not involve any direct or indirect interaction between the people conducting the actions and human activities within the sanctuary.

Other actions proposed under alternatives B and C involving modifications to OCNMS regulations would also have negligible effects on the historical/cultural setting. These include:

- Technical clarifications to OCNMS regulations as outlined in the Sanctuary Operations Action Plan (strategy OPS 9, activity H)

- Replacing the term “traditional fishing” with “lawful fishing”
- Modifications to the tribal welfare permit provision in the OCNMS regulations

The technical clarifications to OCNMS regulations proposed in alternatives B and C would have negligible effects on the human/socioeconomic setting within or around the sanctuary because the changes are language clarifications that do not alter the meaning or intent of the regulations.

The current OCNMS regulations define the term “traditional fishing” as “using a fishing method that has been used in the sanctuary before the effective date of sanctuary designation (July 22, 1994), including the retrieval of fishing gear” and provide an exception for traditional fishing operations to three of the regulatory prohibitions – prohibitions on discharge of certain fishing-related materials, disturbance to historical resources, and disturbance to the seabed. OCNMS regulations could be interpreted to mean fishing methods or operations not falling within the definition of “traditional fishing” are not allowed to discharge materials mentioned above, or disturb historical resources or the seabed.

As part of this action, NOAA proposes to replace the term “traditional fishing” with the term “lawful fishing” in these three places to: 1) use a more clearly understood term; and 2) eliminate the distinction between fishing methods used before OCNMS designation from those authorized after designation. By replacing the word “traditional” with “lawful” NOAA would unambiguously recognize fishing activities authorized by governmental fisheries management authorities. This change is expected to have a negligible effect because Federal, state, tribal and regional fishery management authorities currently analyze and attempt to mitigate impacts associated with lawful fishing, including that which has occurred traditionally in the sanctuary, and those authorities are expected to do the same in the future. Since the scope and impacts of any such future management actions are speculative at this point, it is not possible, and would be inappropriate, to speculate on any additional impact analysis in this document. See section 8.1.1 for more discussion on the regulatory change to replace the phrase “traditional fishing” with “lawful fishing”.

Under the current regulations, OCNMS can issue a permit to conduct an activity otherwise prohibited if it finds that the activity will meet criteria identified in the regulations. One of the criteria listed for permit issuance is to “promote the welfare of any Indian tribe adjacent to the sanctuary.” This provision is ambiguous and could be interpreted as allowing an entity not affiliated with a tribe to apply for a permit that it alleges could promote the welfare of an Indian tribe adjacent to the sanctuary. By modifying the tribal welfare permit language, OCNMS is clarifying the intent of its regulations to ensure it is used to promote or enhance tribal self-determination and not to be used by outside parties. Because this regulatory change does not alter the availability of this permit category to American Indian tribes adjacent to the sanctuary, nor change the requirement that the permitted activity will not substantially injure Sanctuary resources and qualities, this modification to the permitting regulations is expected to have a negligible effect on the human/socioeconomic setting. See section 8.1.1 for more discussion on the regulatory change to clarify the permitting language.

Alternative C would include a ban on the discharge of invasive species in the sanctuary. ONMS is unaware of any current human activities in the sanctuary involving or in any way requiring the discharge of invasive species other than open ocean aquaculture, which is addressed in

section 8.4.3.4. Ballast water discharge in the sanctuary is already prohibited by the state of Washington ballast water discharge regulations (except mid-ocean exchanged ballast water). Thus, an OCNMS invasive species discharge ban would have no additional socioeconomic effect on the shipping industry. Moreover, an OCNMS invasive species discharge ban would not require ship operators to conduct any additional vessel inspections or ballast water analyses. Thus, it is assumed there would be no socioeconomic effect on commercial or recreational fishing operations in the sanctuary from the enactment of an invasive species discharge ban.

Finally, alternatives B and C also contain some structural changes not included in alternative A. Under alternatives B and C, the management plan would contain performance measures, cost estimates and an implementation table. Alternatives B and C also would include a revised suite of goals and objectives for OCNMS. While these structural modifications would have a negligible effect on the human/socioeconomic setting in the sanctuary, they are important to note because these modifications do provide additional clarity and detail to alternatives B and C.

8.4.2 Actions with Beneficial Effects to the Human/Socioeconomic Setting

There are several actions occurring in one or more of the alternatives expected to have a beneficial effect on human/socioeconomic setting within and around the sanctuary. These actions include:

- Routine activities conducted as part of OCNMS' resource protection, research, visitor services, outreach, education, vessel operations, maritime heritage and administrative program areas
- Beach and intertidal activities (student field trips, beach debris removal)
- Encouraging visitor use of beaches and intertidal areas
- A regulatory ban on cruise ship discharge (alternatives B and C)

8.4.2.1 Routine Activities

Many of the routine and general education, outreach, research, resource protection, administrative, maritime heritage and visitor services actions taking place under all three alternatives would have an indirect, short-term, less than significant and beneficial effect on the human/socioeconomic setting within the sanctuary. These routine actions involve the continuation of OCNMS' primary program areas, including:

- Resource protection and stewardship activities
- Research activities, including anchoring research buoys
- Operating sonar and sediment sampling (for hydrographic surveying)
- Routine outreach activities, including encouraging visitor use of the shoreline
- Routine education activities
- Vessel operations
- Maritime heritage activities
- Routine visitor services activities
- Routine administrative activities

These program areas are expected to have less than significant, indirect, and beneficial effects on the human/socioeconomic setting because they would advance regional ocean governance

through improved coordination and collaboration, and improve the value of the sanctuary for educational and research activities. Providing education programs and curricula to schools in disadvantaged communities on the outer coast could provide an economic benefit to those communities, which otherwise might have to fund development of such education programs or curricula. Additionally, providing signage and interpretive programs about the sanctuary could provide an economic benefit to local communities by enhancing tourism opportunities. While all of these routine actions would be beneficial, it is not expected their effects would be significant. The expected implementation period of the management plan is no more than 10 years; thus, the actions proposed within all three management plan alternatives are not projected to last longer than 10 years. It is not likely a significant improvement on the human/socioeconomic setting would be achieved on such a short timeframe as a result of these types of indirect beneficial actions.

Additionally, it should be noted the very existence of the sanctuary and its routine work programs have a beneficial and intangible effect on the human environment not measurable in dollars without conducting a complex and costly economic study of the non-use values of the sanctuary. This was deemed unnecessary by NOAA given the expected low negative impact of the proposed actions on the human/socioeconomic setting. In simple terms, OCNMS has both ecological and aesthetic values. The ecosystem provides ecological services that benefit human beings (e.g., primary productivity at the base of the marine food web). In addition, the sanctuary is a place where people can visit and experience a marine environment in a relatively undeveloped condition, with terrestrial wilderness at their back and the vast Pacific Ocean stretching beyond the horizon. Such experiences have an unquantifiable intrinsic value. Under all three alternatives, the intrinsic societal benefit of maintaining the sanctuary's programs, while difficult to quantify, is an important consideration.

For nonconsumptive users and passive users, ecosystem conditions are important for determining benefits. Resource protection is known to change the status of the habitats protected and often results in positive changes to community structure and increased biodiversity. One of the main benefits is protection of a naturally functioning ecosystem (i.e., a more natural system minimally influenced by human beings) that is expected to have benefits for passive and nonconsumptive users. Naturally functioning marine ecosystems composed of diverse biological assemblages are hypothesized to be more likely to adapt to the increasingly acidic ocean conditions expected as a result of climate change, and are perhaps less likely to develop hypoxic conditions. Should this hypothesis be correct, the socioeconomic benefits to passive and nonconsumptive users of protecting naturally functioning marine ecosystems such as OCNMS would be substantial. Additionally, the resulting resilience of the sanctuary ecosystem, in combination with greater public awareness of this resilience through OCNMS education and outreach programs, can be expected to further increase benefits flowing to passive and non-consumptive users over time. Passive and nonconsumptive user groups may even have a willingness to pay for these increased benefits. Even if the per capita socioeconomic benefit to passive and nonconsumptive users of these ecosystem services is relatively small, the overall magnitude of these benefits is still potentially large. The probable size of the passive user community is in the order of many millions of users throughout Washington State and the nation, and the cost of passive use is generally small relative to other use costs.

8.4.2.2 Cruise Ship Discharges – Effects to the Human/Socioeconomic Setting

Representatives from the North West & Canada Cruise Association polled participating cruise ship lines and found represented vessels currently do not discharge to OCNMS waters for several reasons (John Hansen, former president NWCCA, personal communication). The opportunity to discharge in the sanctuary is limited by a short transit time (mean of 1.2 hours; Table 11), as well as a complex suite of voluntary and regulatory provisions in the NWCCA MOU, MARPOL, the CWA, and the VGP. In order to avoid discharges within the sanctuary, holding tank capacity of about 800 to 4,500 gallons for treated sewage and 5,000 to 18,000 gallons for graywater would be required. According to the EPA, cruise ship capacity to hold sewage (untreated or treated) ranges from 0.5 to 170 hours, with an average holding capacity of 62 hours (EPA 2008). According to the EPA, cruise vessel capacity to hold graywater varies significantly. According to responses to EPA's 2004 cruise ship survey, graywater holding capacity ranges from 5 to 90 hours, with an average holding capacity of 56 hours (EPA 2008). Based on comparison of transit times through OCNMS with EPA's estimates, it is assumed all cruise ships currently operating in Washington state waters have sufficient holding tank capacity to retain sewage and graywater while within the sanctuary. Therefore, avoidance of wastewater discharges during this small time window would not negatively impact vessel operations.

As reviewed in section 6.1.3.1 and outlined in Table 17, there are several regulations and guidelines governing sewage (blackwater), graywater and other discharges to the sanctuary from large vessels, including cruise ships. Foreign flagged cruise ships from countries that have ratified MARPOL annex IV (probably the majority of the cruise ship fleet that transits the sanctuary) are subject to MARPOL Annex IV regulations. Even vessels not subject to MARPOL regulations (i.e., flagged from countries that have not ratified MARPOL Annex IV) are subject to CWA regulation. Washington State water quality regulations prohibit the discharge within state waters of treated effluents from any vessel that do not meet state water quality standards. The VGP addresses discharge of graywater, or sewage mixed with graywater, and numerous other effluents within 3 mi from shore. Members of the NWCCA are subject to the NWCCA MOU, a voluntary measure with measures that apply within the sanctuary.

OCNMS is a defined marine jurisdiction identified on nautical charts with unique regulations governing discharges and other aspects of vessel operations. The complex suite of regulations and agreements governing wastewater discharges in OCNMS make it difficult for vessel operators to be sure where within the sanctuary it is appropriate to discharge various treated and untreated wastewater effluents. Moreover, the four national marine sanctuaries off California have regulations prohibiting discharge of wastewater from large vessels that apply to cruise ships. The discharge prohibition proposed for cruise ships provides regulatory clarity and eliminates ambiguity associated with various wastewater discharges at various distances from shore under various conditions.

Because cruise ships in the sanctuary typically are in transit to other locations and would already be spending the fuel and time necessary to traverse the sanctuary, no additional fuel costs are anticipated as a result of the proposed regulations. Furthermore, for vessel captains, regulatory consistency between national marine sanctuaries on the West Coast may be desirable as it reduces the complexity of operations that span multiple jurisdictions with diverse regulatory requirements and limitations (John Hansen, former president NWCCA, personal communication). In sum, restrictions on discharges from cruise ships under alternatives B and C

could be considered to have a less than significant effect on the human/socioeconomic setting. In addition, NOAA does not expect there to be any significant effect on employment, incomes, or housing due to the cruise ship discharge regulations proposed under alternatives B and C. As a result, NOAA expects less than significant, beneficial, direct, short term or long-term effects on the socioeconomics of the regulated community.

Table 17 Regulatory framework governing graywater and (sewage) blackwater discharges from vessels over 300 GT into OCNMS

Regulation or Agreement	Waste Type	Discharge Conditions
MARPOL Annex IV	Comminuted and disinfected sewage using an approved system	<ul style="list-style-type: none"> • > 3 nmi from shore
MARPOL Annex IV	Sewage stored in holding tanks (untreated and treated sewage)	<ul style="list-style-type: none"> • > 12 nmi from shore; and • Discharged while underway
MARPOL Annex IV	Treated sewage effluent discharged through an IMO approved sewage treatment plant (STP), also integrated system where the STP includes <ul style="list-style-type: none"> • graywater input • food processing input 	<ul style="list-style-type: none"> • Allowed any distance from shore if the following conditions are met; • Effluent not to produce visible floating solids nor cause discoloration of surrounding water
Clean Water Act	Untreated sewage	<ul style="list-style-type: none"> • > 3 mi from shore
Clean Water Act	Sewage treated by a USCG approved MSD	<ul style="list-style-type: none"> • Any distance from shore
Vessel General Permit	Sewage	<ul style="list-style-type: none"> • Not covered by VGP
Vessel General Permit	Untreated or traditional MSD treated graywater, or graywater mixed with sewage	<ul style="list-style-type: none"> • >3 mi from shore
Vessel General Permit	AWTS treated graywater or graywater mixed with sewage	<ul style="list-style-type: none"> • Any distance from shore if effluent limits are achieved and documented through monitoring
Washington State Water Quality Standards (WQS) (per Chapter 90.48 RCW and Chapter 173-201A WAC)	Traditional MSD treated sewage	<ul style="list-style-type: none"> • In State waters* • Must meet marine WQS at point of discharge
Washington State Water Quality Standards (WQS)	AWTS treated sewage and graywater	<ul style="list-style-type: none"> • In State waters • Only allowed outside 0.5 mile from shellfish beds • Must meet terms outlined in NWCCA MOU
NWCCA MOU	Untreated sewage	<ul style="list-style-type: none"> • Outside of State waters
NWCCA MOU	Residual Solids from Type II MSD or AWTS	<ul style="list-style-type: none"> • > 12 nmi from shore • Outside of State waters and OCNMS boundaries
NWCCA MOU	Traditional MSD treated sewage	<ul style="list-style-type: none"> • Outside of State waters
NWCCA MOU	AWTS treated waste (blackwater and graywater)	<ul style="list-style-type: none"> • >1 mi from shore and >6 knots if certain requirements are met and effluent is continuously monitored; and • Not within 0.5 miles from shellfish beds

*State waters include the Puget Sound and the Strait of Juan de Fuca south of the international boundary with Canada; and for off the west coast, the belt of seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with open sea and the line marking the seaward limit of inland waters, and extending seaward a distance of three nautical miles.

8.4.3 Actions with Adverse Effects to the Human/Socioeconomic Setting

There are some actions being considered under alternatives B and C potentially resulting in adverse effects to the human/socioeconomic setting, including:

- Reducing the OCNMS overflight regulation from 2,000 feet to 1,000 feet (alternative C)
- A regulatory ban on discharges from large vessels (alternative C)
- Evaluate options to make compliance with the Area-to-be-Avoided mandatory (alternative C)
- Regulatory ban on the discharge of invasive species (alternative C)

For purposes of this analysis, adverse effects to the human/socioeconomic setting are those negatively affecting the overall economy, business activity, employment, incomes, or housing for those populations adjacent to or dependent on the sanctuary. Adverse effects could result if these regulations caused the communities described in section 6 to:

- Experience reduced employment levels
- Experience decreased wages to cover potential increased costs of regulatory compliance
- Experience a decrease in business activity in or near coastal communities
- Incur increased operational costs by altering routes to avoid discharges in the sanctuary

The significance of any adverse socioeconomic effects must be carefully considered. There exist some administrative definitions of significance. Presidential Executive Order 12866 defines a significant impact for Federal Regulations as any impact of \$100 million or more. When the impact of a Federal Regulation is expected to have impacts of \$100 million or more, then the requirement is the Federal agency proposing the regulation must conduct a benefit-cost analysis of the regulation. None of the actions proposed under any of the three alternatives considered here would cause this level of socioeconomic impact.

Frequently, a threshold of \$1 million is used to define the socioeconomic significance of an action. If the action causes an economic loss of \$1 million or more then it is considered significant. If it causes an economic loss of less than \$1 million then it is not considered significant. Within the context of this analysis, a \$1 million threshold makes sense and is applied when considering the effects of actions on large industries (e.g., the cruise ship industry). However, this threshold does not necessarily make sense when considering economic effects on the small rural communities adjacent to the sanctuary, which have high poverty and unemployment rates. An economic loss of less than \$1 million dollars could be significant in these communities.

The National Marine Fisheries Service (NMFS) considers impacts of five percent or more of a fishing community's income or employment to be significant. Fishing communities are defined as Census Designated Places or cities depending directly or indirectly on the recreational and commercial fisheries for at least 20 percent of either their income or employment, or in which 20 percent of the population living in the community is directly or indirectly dependent on the fisheries. When evaluating socioeconomic effects specifically to fishing communities, OCNMS has considered the NMFS significance standard of five percent or more of a fishing community's income or employment. For the purposes of this analysis, the communities directly adjacent to

the sanctuary are considered to be fishing communities. Neah Bay, La Push and Westport (which is not directly adjacent to the sanctuary but is a community close to the sanctuary) have been identified by NMFS as fishing communities (NMFS 2007). Taholah, WA is not identified in NMFS's Community Profiles for West Coast and Pacific Fisheries as a fishing community; however, for the purposes of this analysis, OCNMS considers Taholah to be a fishing community given the importance of fishing to the Quinault Indian Nation.

8.4.3.1 Regulatory Reduction in Overflight Floor (alternative C only) – Effects to the Human/Socioeconomic Setting

A modification of the OCNMS overflight regulation to lower the floor from 2,000 feet to 1,000 feet would provide regulatory consistency between national marine sanctuaries on the West Coast but simultaneously create an OCNMS regulation inconsistent with the FAA advisory for the same air space that applies to the national park and national wildlife refuges off the outer coast of Washington. ONMS believes a lower flight floor would not alter the number or type of planes flying over the sanctuary, but it could affect the socioeconomic setting of the sanctuary by increasing the noise detectable and visual impact to visitors on the shoreline adjacent to the sanctuary, much of which is designated wilderness within Olympic National Park. Federal wilderness lands are characterized as areas of undeveloped land retaining its primeval character and influence, without permanent improvements or human habitation. Designated wilderness is protected and managed so as to preserve its natural conditions, and where the imprint of man's work is substantially unnoticeable, and there are outstanding opportunities for solitude. The 2,000 foot FAA advisory applying to national parks and wildlife refuges mitigates the visual and acoustic impact to wildlife as well as human visitors. Based on inconsistency between this proposed regulation and FAA advisory for the same area as well as its affect to the aesthetic value of the ONP wilderness shoreline, this alternative would have a less than significant, adverse, direct, and long-term effect on human/socioeconomic resources because potential confusion concerning overflight regulations and advisories may be introduced and the wildness aesthetic may be compromised. Because this alternative is unlikely to cause socioeconomic impacts to Olympic National Park, local communities or the aviation industry on the order of \$1 million or greater, the socioeconomic effects are considered less than significant.

8.4.3.2 Changes to Vessel Discharge Regulation (alternative C) – Effects to the Human/Socioeconomic Setting

Alternative A (no action) does not propose additional discharge regulations on vessels in the sanctuary. As a result, no significant adverse short-term or long-term direct or indirect impacts on the human/socioeconomic setting are expected to occur from alternative A. Alternative B does propose a ban on cruise ship discharges, but this action is expected to have a beneficial, long-term, direct effect on the human/socioeconomic setting and thus is not discussed within the context of adverse effects.

The large commercial vessel discharge regulation proposed under alternative C has potential to cause some adverse effects to the human/socioeconomic resources. Alternative C proposes an expansion of discharge regulations to include a ban on all discharges from large vessels (over 300 gross tons), with the exception of some clean discharges required for vessel operation and an exception for vessels not able to comply based on their existing design, i.e., sewage or graywater holding capacity. Affected vessels 300 gross tons and above could include public vessels, commercial vessels, passenger vessels (other than cruise ships), fishing vessels and tank vessels.

These vessels operate throughout the OCNMS and conduct a wide range of the activities described in section 6 (Human/Socioeconomic Setting).

Some large vessel operators could incur additional costs, resulting from changes in operating procedures, required for compliance with OCNMS vessel discharge regulations under alternative C in order to continue their activities in the sanctuary. These effects would be applicable to:

- Large commercial vessels using the sanctuary for transit
- Commercial fishing vessels using the sanctuary for transit or for fishing operations
- Defense-related vessels using the sanctuary for transit or for training
- Research-related vessels using the sanctuary for transit or for research

Impacts to U. S. Navy vessels should be negligible. The Navy's current policy is "While transiting National Marine Sanctuaries, ships and submarines shall avoid any adverse impacts on Sanctuary resources and qualities. Ships and submarines shall minimize, to the maximum extent practicable, any solid waste, sewage, or bilge water discharges" (Section 22-922-2.2.10 Prohibited Discharge Zones for U.S. Navy Shipboard Wastes, of OPNAVINST 5090.1C, U.S. Navy 2007). Moreover, OCNMS regulations include an exception to the discharge prohibition for identified military activities performed by the Department of Defense in operations areas W-237A, W-237B, and MOAs Olympic A and B that cover the majority of OCNMS (Figure 10).

Alternative C would have a minimal effect on the operation of large commercial vessels transiting OCNMS en route to and from Puget Sound and Canadian Ports with respect to sewage and graywater management. Most large commercial vessels traversing the sanctuary are expected to have adequate sewage and graywater holding capacity to avoid discharging during the typically short 1.2 to 3.6 hour (Table 11) transit of the OCNMS. Most large commercial vessels have relatively small crews (e.g., 4 - 15 people), and thus do not generate sewage or graywater in volumes comparable to cruise ships. In order to avoid sewage discharges within the sanctuary, an estimated holding tank capacity of between 5 and 30 gallons would be required; and most large vessels have this capacity. Likewise the volume of graywater generated and potentially discharged in the sanctuary is relatively small. Although there is significant variation among vessels, most large commercial vessels have sufficient storage capacity for graywater to allow vessel operations for 20 to 48 hours without discharge (Pruitt 2004). Although sewage and graywater holding capacity likely exists on most ships, operational procedures for securing overboard discharges would need to be developed and implemented.

For all vessels, no additional costs related to fuel and transit time are expected to occur with implementation of alternative C. Since the practice of calling on Puget Sound and Canadian ports is expected to continue compliant with the CVTS and ATBA, with or without implementation of alternative C, impacts to vessels currently complying with the ATBA (vessels >1,600 GT) would be negligible. Rather, alternative C would simply prompt large commercial vessels to hold their sewage until they are outside the sanctuary boundary.

Vessels operating in the OCNMS for substantial lengths of time are potentially more affected by the provisions of Alternative C than large commercial vessels. Vessels such as public research vessels and commercial fishing vessels may remain in the sanctuary to perform their allowed functions. These vessels may not have adequate capacity to retain sewage and graywater while

within OCNMS. However, under Alternative C, exceptions to this rule are allowed based on a vessel's existing design and holding tank capacity. As an example the NOAA Ship *McArthur II*, a 224 foot 1,914 GT research vessel, occasionally conducts research cruises within OCNMS. The *McArthur II* has a combined sewage and graywater holding tank of 4,000 gallons, which for a typical crew of 37 provides a wastewater holding capacity of approximately 2 days. Without the exception for vessels not able to comply based on their existing design, the *McArthur II* would be required to break from research operations every other day to transit to an area where discharge of sewage and graywater were legal. With this exception, under this alternative, there would be an allowance for the vessel's existing design and holding tank capacity.

Some commercial fishing vessels operating in OCNMS are greater than 300 GRT and would therefore be regulated under Alternative C. The NOAA Vessel Monitoring System (VMS) data analyzed by OCNMS, which includes participating commercial fishing vessels, does not include the tonnage of the vessel, so the number of commercial fishing vessels 300 GT or above (those affected by alternative C) is unknown. However, the CVTS data set does include tonnage. Of the fishing vessels documented in CVTS data, 23% were 300 GT or above (Table 11; see Appendix K for a description of VMS and CVTS data.). For commercial fishing vessels, time spent in the sanctuary is a combination of transit and fishing time. Table 11 estimates the average duration of commercial fishing vessel transits (vessels not actively fishing) ranges from 2.6 to 3.2 hours. Holding tank capacity of about 3 to 14 gallons for sewage and 17 to 56 gallons for graywater would be required in order to avoid discharges while in the sanctuary during transits. However, fishing vessels actively fishing could spend a significantly longer period of time in the sanctuary. Based on VMS data, there were 153 fishing trips, or approximately 5% of fishing trips in 2009, exceeding two days. Based on this information it is reasonable to conclude there are fishing vessels greater than 300 GT in the sanctuary for a period of time that would exceed their holding tank capacity. Again, the exemption for existing vessel design would mitigate the impact of this alternative.

While the exemption for existing vessel design greatly mitigates the financial impact from this regulation, there would be some minimal costs involved in complying with the regulation. Large commercial vessel operators, in particular, would need to establish procedures for securing overboard sewage and graywater discharge. These costs would vary based on vessel design and operations. The adverse effects of this alternative would be less than significant, direct and long-term. The effects are considered less than significant because, given the exception for existing vessel design and the existing capacity of most vessels to adhere to the proposed regulation without major modifications to their structures or routes, it is unlikely this regulatory change would cause a loss of \$1 million or more to any industry.

8.4.3.3 Area-to-be-Avoided – Effects to the Human/Socioeconomic Setting

Currently, the Olympic Coast Area to be Avoided (ATBA) is an International Maritime Organization (IMO) voluntary vessel routing measure for vessels 1,600 gross tons and above. The ATBA has been in place since 1994, and its compliance rate has been high, estimated to be 98.9% in 2009 (WDE 2010). To maintain the high compliance rate, OCNMS works with the USCG to notify non-compliant vessels with a formal letter requesting they adhere to the ATBA in the future.

Under alternative C, OCNMS would work with its partners to evaluate options to make compliance with the ATBA mandatory. In order to understand the extent and potential significance of changing the voluntary nature of the ATBA, OCNMS evaluated ATBA compliance rates and identified the population of vessels not voluntarily complying with the ATBA. OCNMS further evaluated responses from the ATBA Monitoring and Outreach program to evaluate response from industry on reasons for non-compliance.

The transits of vessels for which the ATBA applies off the Olympic Coast in 2009 are summarized in Table 15. In 2009, 8,849 transits (vessels for which the ATBA applies) were tracked by Cooperative Vessel Traffic Service (CVTS) monitoring. Of these transits, 6,128 entered OCNMS (Figure 11), with a total of 68 transiting within the ATBA (Figure 12). In 2009 the ATBA voluntary compliance rate was estimated at near 99%.

To better understand the reasons for non-compliance for these 68 transits ONMS reviewed responses from these vessels (see 8.2.1.4). The sanctuary has concluded changing the ATBA provisions from voluntary to mandatory would have a minimal impact in the behavior of shipping in the sanctuary. There would be some increased costs to both the government and the maritime industry in implementing a mandatory ATBA provision. The effect of this alternative would be less than significant, adverse and long-term. The effect is expected to be less than significant because, given the nearly perfect compliance rate with the ATBA that already exists, there is no indication this change to the ATBA would lead to a loss of \$1 million or more to the shipping industry.

8.4.3.4 Regulatory Ban on Invasive Species Discharge – Effects to the Human/Socioeconomic Setting

Alternative C would include a ban on the discharge of invasive species in the sanctuary. It is assumed this action could have some adverse effect on the human setting because it would restrict people from farming invasive species (e.g., Atlantic salmon) in the sanctuary, although ONMS could consider granting a permit for an aquaculture project on a case-by-case basis. An OCNMS permit would be required for any aquaculture project in the sanctuary because such a project would trigger OCNMS' discharge or seafloor disturbance regulations. Therefore, potential impacts of invasive species would be an additional consideration for OCNMS permitting if such a project were proposed. It is assumed the adverse socioeconomic effect of this regulation would be less than significant because ONMS has never received an application from any entity seeking to farm an invasive species in OCNMS and knows of no plans under development at this time. Thus, ONMS, through this regulatory change, would not expect to cause any significant (>\$1 million) economic losses to the aquaculture industry. It is also important to note a ban on discharging invasive species in the sanctuary would not be equivalent to a ban on aquaculture in the sanctuary. Farming operations involving native species would be considered but, as noted above, likely would require an OCNMS permit.

8.4.4 Summary of Effects to Human/Socioeconomic Setting

In general, the majority of actions being considered under alternatives A, B and C would have some beneficial, less than significant effects on the human/socioeconomic setting in the sanctuary. There is not a substantial difference in the beneficial effects expected from the three alternatives.

The actions under both alternatives A and B are expected to have solely beneficial effects on the human/socioeconomic setting. The actions under alternative C are expected to have primarily beneficial effects on the human/socioeconomic setting, but also may have some less than significant, adverse effects.

The beneficial effects of all three alternatives are considered less than significant because, while the actions under these alternatives are critical to achieving OCNMS' goals and objectives, they are relatively small in scale and are not expected, to cause a large and measurable improvement to the socioeconomic health of local communities over the life of the management plan (five to ten years). That is not to say revising the OCNMS management plan will not *contribute* positively to local and regional socioeconomic improvements by promoting tourism on the Olympic Peninsula, providing resources to local school systems for educational programs etc.

Regarding adverse effects to human/socioeconomic setting, the additional actions being considered under alternative C would have a less than significant adverse, direct, short and long-term effects on the socioeconomics of local communities. These effects could include minor increases in operating costs or foregone economic opportunities. No significant macroeconomic or fiscal impacts are expected. It is important to note, while significant effects on local economies are not expected as the result of any of the three management plan alternatives, that does not necessarily mean there would or wouldn't be significant effects on certain individuals or groups. Certainly if a person were among those who are impacted it could feel significant to that person. OCNMS has no basis for judging significance in this context. This analysis simply provides OCNMS' best estimates of the extent of potential effects on communities overall.

8.5 CUMULATIVE EFFECTS

The National Environmental Policy Act and the White House Council on Environmental Quality (CEQ) require federal agencies consider the cumulative environmental effects of the action(s) they propose. The cumulative effect of the proposed action is the incremental environmental effect the proposed action has when added to other past, present and future actions in the affected environment. Cumulative effects are critical to explore because it is often the combined effect of many actions in one area or region that causes the most significant adverse effects.

Analyzing cumulative effects and assessing their significance can be challenging. OCNMS considers cumulative effects to be significant if they exceed the capacity of a resource (socioeconomic, biological, physical, historic and/or cultural) to sustain itself and remain productive. In order to analyze cumulative effects, OCNMS followed informal CEQ guidelines as documented in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997). In these guidelines, CEQ presents an 11-step process for reviewing and assessing cumulative impacts.

Actions identified under alternatives A, B and C as causing any beneficial or adverse effects to resources were reviewed to identify potential cumulative issues. The geographic scope and time frame for the cumulative effects analysis are the same as for the management plan review, i.e., the existing boundaries of OCNMS and a 5-10 year time frame. In conducting this analysis OCNMS utilized the findings from the 2008 Condition Report as a baseline (ONMS 2008).

Process for Reviewing and Assessing Cumulative Impacts (CEQ 1997)

- Step 1** – Identify the potentially significant cumulative effects issues associated with the proposed action and define the assessment goals.
- Step 2** – Establish the geographic scope for the analysis
- Step 3** – Establish the time frame for the analysis
- Step 4** – Identify other actions affecting the resources, ecosystems, and human communities of concern
- Step 5** – Characterize the resources described in the affected environment in terms of their response to change and capacity to withstand stresses.
- Step 6** – Characterize the stresses affecting these resources and their relation to regulatory thresholds
- Step 7** – Define a baseline condition for the resources
- Step 8** – Identify the important cause-and-effect relationships between human activities and the resources
- Step 9** – Determine the magnitude and significance of cumulative effects
- Step 10** – Modify or add alternatives to avoid, minimize or mitigate significant cumulative effects.
- Step 11** – Monitor the cumulative effects of the selected alternative and adapt management.

The analysis of cumulative effects considers the present effects of past actions to the extent they are relevant and useful in analyzing whether the reasonably foreseeable effects of the Proposed Action and future projects would collectively result in a significant effect on the environment.

The following projects include only those with some potential to contribute to the cumulative effects:

- Seafloor disturbance
- Noise pollution
- Vessel operations
- Trampling
- Invasive species regulations
- Vessel discharge regulations
- Climate change
- Marine resource protection

8.5.1 Cumulative Effects of Seafloor Disturbance

There are two primary types of OCNMS operations disturbing the seafloor - anchoring of research moorings and bottom grab samples. Analysis of these actions has found them to be less than significant, adverse, direct and short-term to the biological, physical and historic and cultural setting of the sanctuary. Other non-OCNMS actions within the boundaries of the sanctuary that also disturb the seafloor and which contribute to the cumulative impacts to these resources include the installation of cables, bottom contact fishing gear, the Quillayute River Harbor Project, the abandonment of sunken vessels, some Naval operations, and the conduct of non-OCNMS research activities.

The 2008 Condition Report concluded selected habitat loss or alteration has taken place from human activities, and the most significant impact likely has resulted from bottom contact fisheries conducted for years over broad areas (ONMS 2008). The area of the seafloor disturbed by OCNMS actions is miniscule compared other activities. Therefore, the actions of OCNMS do not significantly contribute to the cumulative effects of seafloor disturbance.

8.5.2 Cumulative Effects of Noise Pollution

OCNMS operations under all three alternatives would contribute to noise in the sanctuary include vessel and survey operations. However, OCNMS activities are small in scope and intensity compared with existing traffic. Additional sources of noise pollution in the sanctuary include commercial shipping and military operations. The primary source of low-frequency ocean noise is commercial shipping (NRC 2003). In 2009 there were approximately 7,000 transits of large vessels (over 300 GT) in the sanctuary (Table 11). An additional source of noise pollution in the sanctuary is military operations, for which there are exceptions to OCNMS regulations provided in 15 CFR 922.152(d). Both the Northwest Training Range Complex and the Quinault Underwater Test Range overlap with the boundaries of OCNMS. Both of these military operating areas have been subject to recent NEPA analysis and MMPA permitting requirements. While the cumulative effects of noise pollution within the sanctuary have not been documented, ONMS believes its contribution to these the cumulative effect would be less than significant, adverse, direct and short-term under all three alternatives, due to the separation in time and space from these vessel operations and the large areas of the sanctuary excluding large vessel transits, e.g., the ATBA.

8.5.3 Cumulative Effects of Vessel Operations

In addition to noise pollution, the operation of vessels within the sanctuary can have an effect on physical and biological setting by providing a potential source of water pollution. Additional effects can occur through harassment of wildlife and/or ship strikes. Current level of OCNMS operations is at approximately 12.5 vessel days (300 hours of operations). This is out of an approximate total of 5,000 vessel days occurring annually in the sanctuary (Table 6). The nature of these operations is generally disbursed with some concentrations occurring at harbor entrances, popular fishing grounds, and in vessel traffic lanes. The 2008 Condition Report concluded water quality in the sanctuary is in good condition (ONMS 2008). Therefore, the cumulative effects of OCNMS vessel operations under all three alternatives would be less than significant, adverse, direct and short-term.

8.5.4 Cumulative Effects of Trampling

Actions occurring in the intertidal zone with potential to have an adverse effect through trampling include:

- Beach and intertidal educational and interpretive programs
- Intertidal surveys
- Marine debris removal projects
- Encouraging visitation to beaches and intertidal areas

Other actions contributing to this type of impact include Olympic National Park and school group interpretive activities, and impacts from the general public's visitation to intertidal areas.

The 2008 Condition Report found that while selected habitat loss or alteration has taken place from human activities, these impacts are unlikely to cause substantial or persistent degradation to living resources (ONMS 2008). Therefore, the cumulative effects of intertidal activities under all three alternatives would be less than significant, adverse, direct and short-term.

8.5.5 Cumulative Effects of Invasive Species Regulations

Alternative C includes a new regulation, which would ban the discharge of invasive species in the sanctuary. Other actions impacting the cumulative effect of this regulation include current state of Washington regulations restricting the introduction of invasive species in state waters. Because the addition of an OCNMS invasive species discharge ban 1) would be largely redundant with state of Washington regulations and 2) would likely not add any significant additional protections for resources in the sanctuary, the cumulative effects of the invasive species regulation would be beneficial, indirect, long-term and less than significant.

8.5.6 Cumulative Effects of Vessel Discharges

Alternatives B and C both contain regulations which would prohibit certain discharges from different classes of vessels in order to support efforts to maintain water quality in the sanctuary. Other actions effecting water quality in the sanctuary include an existing Washington State and Northwest CruiseShip Association Memorandum of Understanding (MOU) that restricts cruise ship discharges in state waters, state of Washington ballast water regulations that restrict vessel

discharges in and adjacent to state waters, the IMO Area-to-be-Avoided, and federal (EPA) water quality regulations (e.g., Clean Water Act).

The 2008 Condition Report found water quality in the sanctuary to be in “good” condition (ONMS 2008). Furthermore, preceding analyses of potential OCNMS vessel discharge regulation changes indicate these potential regulatory changes would have only a small added benefit to water quality in the sanctuary because existing regulations (state, federal and IMO) already provide substantial protection of water quality in most of the sanctuary. The cumulative effect of potential changes to OCNMS vessel discharge regulations in conjunction with existing state and federal water quality protection regulations would be beneficial, indirect, long-term and less than significant.

8.5.7 Cumulative Effects of Climate Change

Climate change is, by nature, a cumulative effects issue. No single point source or event has caused climate change. Rather, the changing climate is cumulatively affected by many actions all over the globe. The United States government has identified climate change as a significant problem of national and international concern. The White House Council on Environmental Quality is currently developing guidelines federal agencies can use to address the issue of climate change in the NEPA process. Through the management plan review process, ONMS has addressed the issue of climate change in detail by developing a Climate Change Action Plan and Sanctuary Operations Plan to be implemented under alternatives B and C. Both of these action plans discuss ways in which ONMS would reduce its carbon footprint and work with local communities in the sanctuary region to understand and address the issue of climate change.

The burning of fossil fuels contributes to the build-up of greenhouse gases in the atmosphere. The build-up of greenhouse gases in the environment in turn influences climate. Alternatives A, B and C contain actions requiring the burning of fossil fuels to support the operation of sanctuary vessels and vehicles. Additionally, there is a significant volume of marine shipping and vessel operations occurring in the sanctuary. Insufficient data exist to characterize the specific effect or contribution of fossil fuel burning in the sanctuary region on or to global climate change. However, given the small scale of OCNMS activities involving fossil fuel burning, it is unlikely OCNMS greenhouse gas contributions under alternatives A, B or C would cause a significant change in the cumulative effect of fossil fuel burning in the sanctuary region. Under all three alternatives, ONMS would continue to maintain a small staff, a small fleet of vehicles and vessels, and would engage in no commercial or industrial-scale fossil fuel burning activities. Thus, the cumulative effects of all three alternatives on climate change are assumed to be adverse, but less than significant.

8.5.8 Cumulative Effects of Marine Resource Protection

Alternatives A, B and C consider actions providing protection for marine resources in the sanctuary. The National Park Service and the U.S. Fish and Wildlife Service also provide protections for marine resources in and adjacent to the sanctuary through the management of Olympic National Park and the Washington Maritime Wildlife Refuge Complex. Thus, there is a less than significant, beneficial, cumulative effect of having multiple federal protection structures (park, refuge and sanctuary) for marine resources in the sanctuary. This cumulative effect under all three alternatives is assumed to be less than significant because the combined

park/refuge/sanctuary area represents a relatively small area of the Pacific Ocean in which these types of protections for marine resources are provided.

8.5.9 Actions for Future Analysis

Many of the actions and strategies under all three alternatives provide broad management direction. Where actions are specific and adequately defined, the environmental consequences have been analyzed. Conversely, actions that are broad and general in nature would be analyzed in future environmental and cultural compliance documents, once sufficiently specific actions are proposed and defined. Examples of actions that may be analyzed in the future include:

- Construction of visitor centers, storage facilities, staff offices, interpretive signage and vessels
- Potential maritime archeological investigations
- Potential discovery of maritime archeological sites requiring development of preservation and protection plans
- Potential submerged marine debris removal projects (e.g., removing buried crab pots, abandoned vessels, etc.)
- Potential OCNMS permit applications to conduct a variety of human development activities in the sanctuary (e.g., fiber optic cable installations, alternative energy projects etc.)

Alternatives B and C both provide guidance for future expansion of OCNMS programs. Specific details for how these programs may expand would not be developed until the resources to support such expansions are available. At that time, appropriate environmental and cultural review and compliance documentation would be developed in accordance with NEPA, NHPA, NOAA guidelines, as well as Endangered Species Act (ESA), CWA, and other federal laws. Additionally, ONMS cannot anticipate the nature of permit applications it may receive to conduct prohibited activities in the sanctuary. Permit applications must be analyzed on a case-by-case basis, and an appropriate level of environmental and cultural compliance documentation would be determined on a case-by-case basis.

8.6 SUMMARY OF EFFECTS

Effects to the physical, biological, historical/cultural, and human/socioeconomic settings were analyzed for each of the three alternatives being considered (Table 18). Effects were classified as beneficial or adverse, direct or indirect, short-term or long-term and significant or less than significant (terms all of which are defined in the introduction to section 8.0). The types of actions analyzed (Table 13) included, but were not limited to:

- Routine OCNMS resource protection, research, education, outreach, visitor services, maritime heritage, administration activities
- Potential changes to OCNMS regulations (related to vessel discharges, invasive species etc.)
- OCNMS vessel operations
- Research and monitoring activities causing seafloor and wildlife disturbance and disturbance to the intertidal zone
- Continuation and potential expansion of the Area-to-be-Avoided

Table 18 Comparison of effects of the three alternatives on physical, biological, historic/cultural and socioeconomic resources

Setting	Effects of Alternative A	Effects of Alternative B	Effects of Alternative C
Physical	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial
Biological	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial
Historic/Cultural	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial
Human/Socioeconomic	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial
Cumulative	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial	Less than significant, adverse and beneficial

Additionally, the cumulative effects of the actions proposed under all three alternatives were analyzed within the context of other federal and non-federal activities occurring in the sanctuary. In all cases, the effects of all three alternatives were found to be less than significant (Table 18).

As the environmental consequences analysis demonstrates, revision of OCNMS' management plan (under all three alternatives) would have an overall beneficial effect on resources in the sanctuary (biological, physical, historic/cultural and socioeconomic). Because the management plan is a broad, guidance document, these beneficial effects would in many cases be indirect, occurring as OCNMS takes actions to improve 1) public understanding of marine conservation issues, 2) scientific understanding of sanctuary ecosystems and historic and cultural resources, 3) marine stewardship and maritime heritage programs, 4) OCNMS regulations in order to reduce potential stressors on marine resources (e.g., vessel discharges, oil spills and potential invasive species introductions). These effects would be less than significant because they alone are not likely to result in a substantial, measurable improvement of resource health over the relatively short life of the management plan (five to ten years).

Measurable changes in the health of resources in the sanctuary will likely occur over a longer period of time, and as the result of incremental changes in human behavior that ONMS hopes to influence through the continuation and development of its research, resource protection, education, outreach, visitor and maritime heritage programs. To say these beneficial effects are less than significant is not to say they are not critical to OCNMS' mission or to resource protection efforts in the sanctuary. Revising the management plan, particularly as discussed under the preferred alternative B, would provide a strategic and detailed path forward for OCNMS and its partners to achieve more effective management and protection of resources in the sanctuary. However, within the context of NEPA, these beneficial effects do not meet the criteria of "significant".

In addition to these beneficial effects, some actions proposed under all three alternatives would cause direct and indirect adverse effects on resources. These adverse effects include, for example, disturbance to wildlife in order to monitor and understand the health of species in the sanctuary, disturbance to the seafloor in order to install water quality monitoring buoys. In all cases, adverse effects were found to be less than significant because ONMS conducts these activities on a small scale, in a manner that substantially minimizes impacts to resources, and in a manner minimizes costs for sanctuary users.

Cumulative effects of actions under all three alternatives were also found to be less than significant. For the most part, this is because the effects of OCNMS actions (beneficial and adverse) are small in scale. Thus, the addition of these effects to those of other similar activities occurring in the sanctuary would not significantly alter the cumulative effects of these activities overall. In some cases, there was little information available to assess the effects of other entities' activities in the sanctuary. In such cases, the information available suggested the cumulative effects would be less than significant. Should additional information about these activities become available in the future, it would be incorporated into future OCNMS NEPA cumulative effects analyses.