June 6, 2011

PETITION TO ESTABLISH A 10-KNOT SPEED LIMIT FOR VESSEL TRAFFIC WITHIN NATIONAL MARINE SANCTUARIES OFF THE CALIFORNIA COAST

BEFORE THE DEPARTMENT OF COMMERCE,
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL OCEAN SERVICE,
AND NOAA OFFICE OF NATIONAL MARINE SANCTUARIES

Center for Biological Diversity
Friends of the Earth
Environmental Defense Center
Pacific Environment

NOTICE OF PETITION

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The Center for Biological Diversity is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 32,000 members and online activists throughout the United States. The Center and its members are concerned with the conservation of sanctuary resources, including marine mammals, sea turtles, and other organisms, and the effective implementation of the National Marine Sanctuaries Act and other applicable laws.

Friends of the Earth is a public interest, non-profit advocacy organization, whose mission is to defend the environment and champion a just and healthy world. Friends of the Earth works to stop environmental damage and to protect human health and the planet by reducing pollution and reducing dependence on fossil fuels. Founded in 1969, Friends of the Earth now maintains its headquarters in Washington, D.C. and its West Coast office in San Francisco and is the U.S. voice of the world's largest network of grassroots environmental groups, with affiliates in 76 countries.

The Environmental Defense Center is a public interest, non-profit environmental law firm that protects and enhances the environment through education, advocacy and legal action. Since 1977, EDC has empowered community based organizations to advance environmental protection, primarily in Santa Barbara, Ventura and San Luis Obispo Counties. EDC program areas include protecting coast and ocean resources, open spaces and wildlife, and human and environmental health. The EDC has been active in Channel Islands National Marine Sanctuary governance since 1998, when the Sanctuary Advisory Council was formed, and has participated on the Sanctuary's subcommittee on whales and shipping.

Pacific Environment is a nonprofit organization based in San Francisco that protects the living environment of the Pacific Rim by promoting grassroots activism, strengthening communities and reforming international policies. For nearly two decades, we have partnered with local communities around the Pacific Rim to protect and preserve the ecological treasures of this vital region.

Action Requested

Pursuant to the Administrative Procedure Act, 5 U.S.C. § 553(e), the Center for Biological Diversity, Environmental Defense Center, Friends of the Earth, and Pacific Environment (collectively "Petitioners") hereby petition the Secretary of Commerce, through the National Oceanic and Atmospheric Administration, National Ocean Service, and Office of National Marine Sanctuaries ("ONMS") (collectively, "NOAA") to establish a 10-knot speed limit for large commercial vessels within the national marine sanctuaries off the California coast.

The purpose of this action is to reduce and avoid significant threats to sanctuary resources, including protected species, due to ship strikes, noise pollution, air pollution, and greenhouse gas emissions. Because NOAA manages the national marine sanctuaries and has jurisdiction over marine mammals, sea turtles, and other marine species in ocean waters under the National Marine Sanctuaries Act, Endangered Species Act, and Marine Mammal Protection Act, NOAA is the proper agency to process this petition.

We recognize the ONMS has undertaken significant research regarding ship traffic impacts to sanctuary resources, particularly with respect to ship strikes on blue whales and other species in and around the Channel Islands National Marine Sanctuary. We submit this petition with the goal of building upon and furthering these important efforts to protect sanctuary resources.

Dated: June 6, 2011

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Table of Contents

INTRODUCTION

According to the National Oceanic and Atmospheric Administration ("NOAA"), the primary management objective of a national marine sanctuary is "to protect its natural and cultural features while allowing people to use and enjoy the ocean in a sustainable way." *See* http://sanctuaries.noaa.gov/about/faqs/welcome.html. California's marine sanctuaries are home to some of the nation's richest marine wildlife habitat as well as some of the most heavily trafficked shipping lanes. As detailed below, the intersection between sanctuary resources and ship traffic provides both challenges and opportunities for improving the management of national marine sanctuaries and the ecosystems they represent. The number of whales killed by collisions with commercial vessels has climbed within recent years to unsustainable levels. Ambient ocean noise from ship traffic continues to raise the din against which marine animals must struggle to carry out normal life. More large and fast ships spew additional pollutants and greenhouse gases into the atmosphere, with associated threats ranging from increased asthma rates and more regional "bad air" days to large-scale problems of climate change and ocean acidification.

Fortunately, the problems share a common solution. Research indicates that lowering ship speeds reduces the likelihood of harmful collisions between ships and whales, decreases the noise emitted by many vessels, and reduces both conventional and greenhouse gas air emissions from ships. In addition, large commercial shipping companies have found that traveling at slower speeds produces significant savings in fuel costs. Despite this benefit, experience demonstrates that voluntary measures and advisories are ineffective in obtaining the necessary reductions in ship speed. Therefore, given the multiple benefits of reducing ship speeds and the imperative need to protect California's coastal and sanctuary resources, we believe that establishing a mandatory 10-knot speed limit for commercial vessels throughout the four national marine sanctuaries off the coast of California is both prudent and necessary.

Accordingly, Petitioners formally petition NOAA to adopt a regulation that establishes:

> **A mandatory 10-knot speed limit for vessels greater than 65 feet within the Cordell Bank, Gulf of the Farallones, Monterey Bay, and Channel Islands National Marine Sanctuaries to protect whales from collisions with vessels and noise pollution, and to provide other benefits associated with reduced speeds that will further protect sanctuary resources.**

In addition to providing much-needed protections for sanctuary resources and marine species required under the National Marine Sanctuaries Act, as well as the Endangered Species Act and the Marine Mammal Protection Act, such a measure would build upon significant existing efforts by regional and state authorities to slow ship speeds off the California coast. As such, this action provides an excellent opportunity to implement the sort of coordinated, forward-looking marine spatial planning called for by President Obama's National Ocean Policy initiative.

Figure 1.

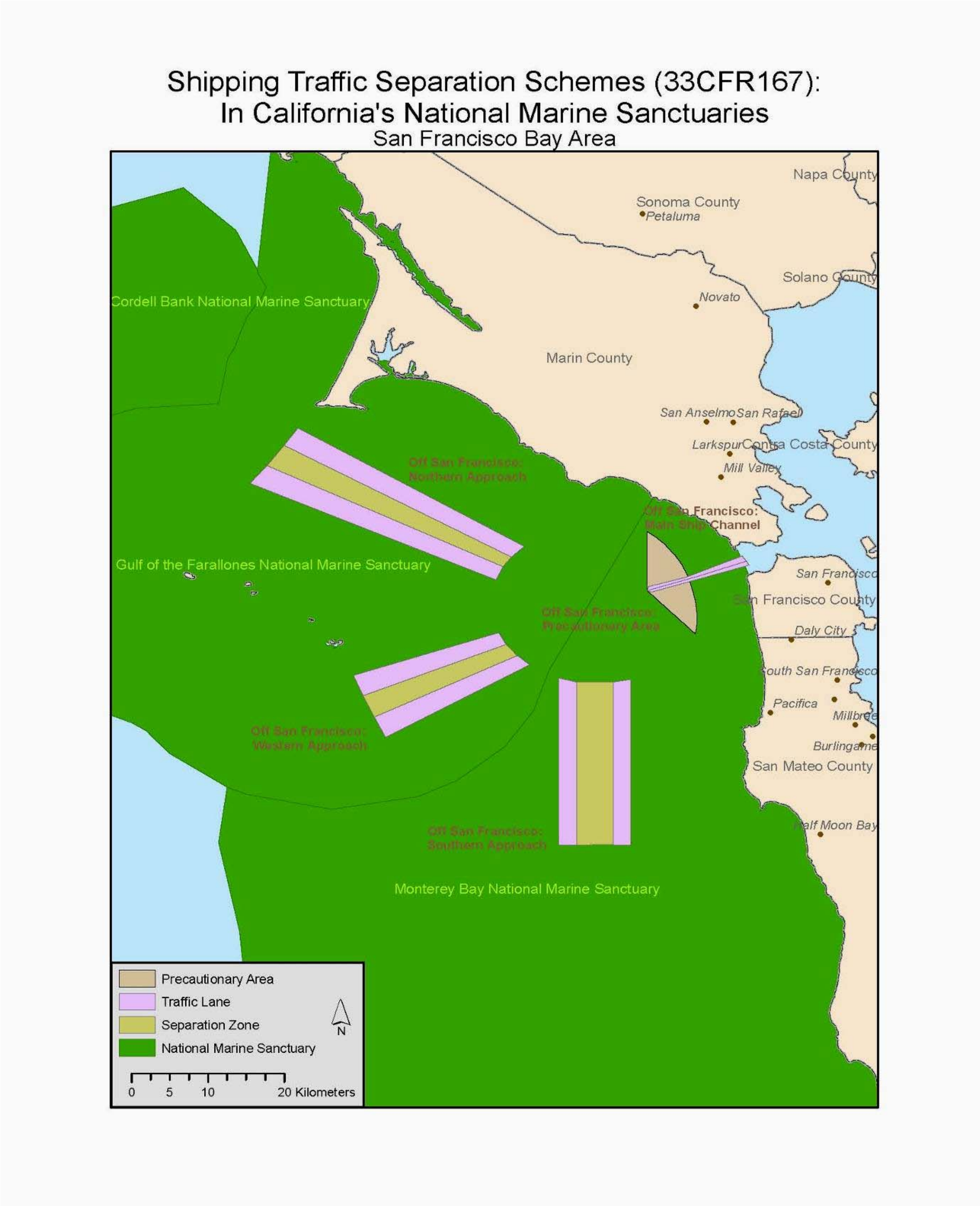
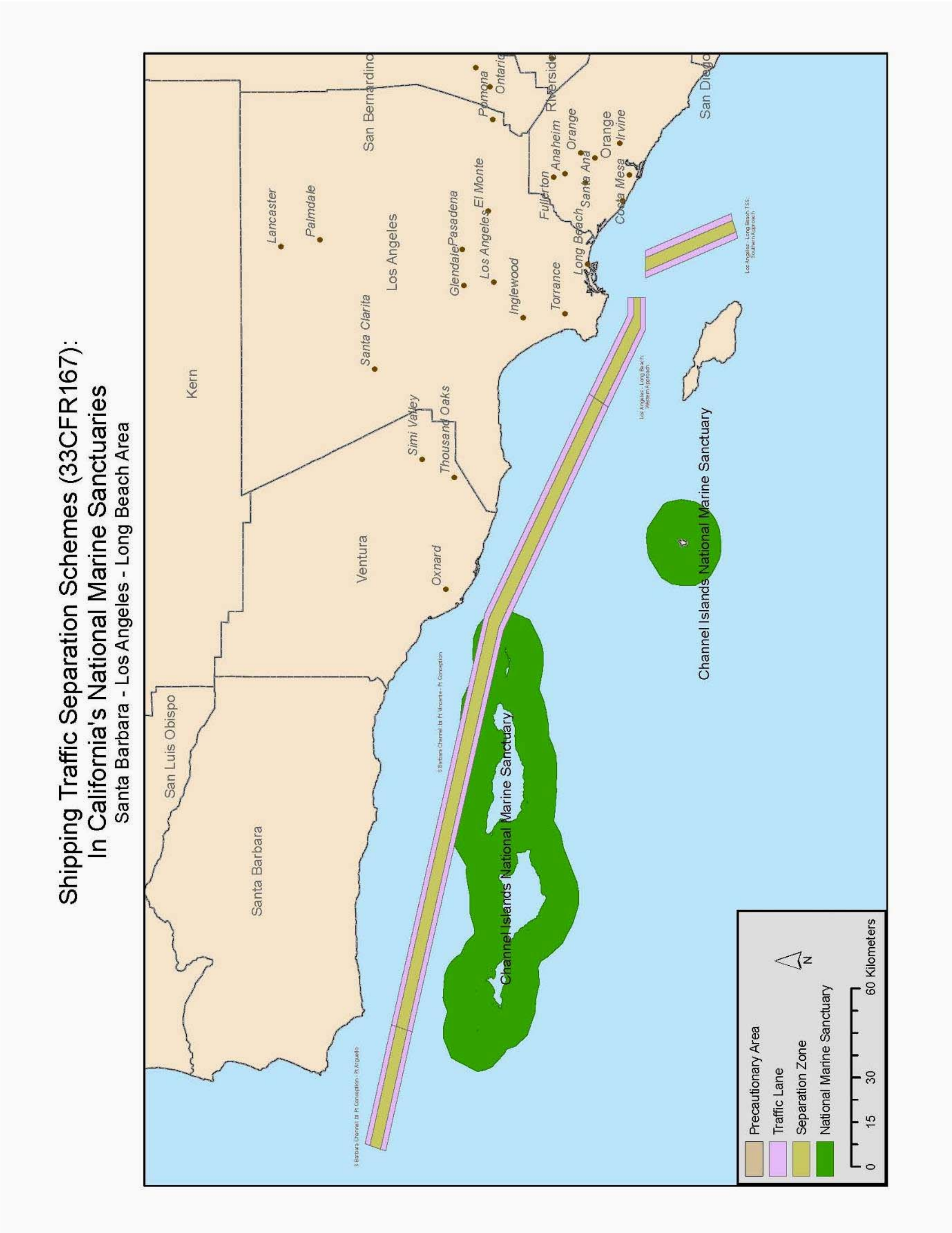

Shipping Traffic Separation Schemes (33CFR167):
In California's National Marine Sanctuaries
San Francisco Bay Area
Napa County
Sonoma County
Petaluma
Solano County
Novato
Marin County
Cordell Bank National Marine Sanctuary
San Anselmo
San Rafael
Larkspur
Contra Costa County
Mill Valley
Off San Francisco: Northern Approach
Off San Francisco: Main Ship Channel
Gulf of the Farallones National Marine Sanctuary
San Francisco
San Francisco County
Off San Francisco: Precautionary Area
Daly City
South San Francisco
Pacifica
Millbrae
Burlingame
Off San Francisco: Western Approach
San Mateo County
Half Moon Bay
Off San Francisco: Southern Approach
Monterey Bay National Marine Sanctuary
Precautionary Area
Traffic Lane
Separation Zone
National Marine Sanctuary
N
0
5
10
20 Kilometers

Figure 2.


Shipping Traffic Separation Schemes (33CFR167):
In California's National Marine Sanctuaries
Santa Barbara - Los Angeles - Long Beach Area
Kern
San Luis Obispo
Santa Barbara
Ventura
Los Angeles
San Bernardino
Riverside
Orange
San Diego
Lancaster
Palmdale
Santa Clarita
Simi Valley
Thousand Oaks
Oxnard
Glendale
Pasadena
El Monte
Los Angeles
Inglewood
Torrance
Long Beach
Pomona
Ontario
Fullerton
Anaheim
Orange
Santa Ana
Costa Mesa
Irvine
Channel Islands National Marine Sanctuary
Channel Islands National Marine Sanctuary
Precautionary Area
Traffic Lane
Separation Zone
National Marine Sanctuary
N
0
15
30
60 Kilometers

I. LEGAL FRAMEWORK

A. National Marine Sanctuaries Act

The National Marine Sanctuaries Act ("NMSA"), 16 U.S.C. §§ 1431-1445C (as amended by P.L. 106-513 (Nov. 2000), protects unique marine areas in order to maintain natural communities, enhance natural habitats and populations, enhance public awareness, and support research on and monitoring of key marine resources. 16 U.S.C. § 1431(b). A national marine sanctuary ("NMS") is designated due to its "special national significance" as an area with "conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or aesthetic qualities. . . the communities of live marine resources it harbors . . . [or] its resource or human-use values." *Id.* at § 1433(a)(1)-(2). The Secretary of Commerce is vested with authority to designate and manage marine sanctuaries; this authority has been delegated to the Office of National Marine Sanctuaries ("ONMS"). *See* http://sanctuaries.noaa.gov/about/legislation. Concurrent with designation, the Secretary must issue a draft management plan for the proposed sanctuary, including the goals of sanctuary designation and strategies for managing sanctuary resources. 16 U.S.C. at § 1434(a)(2)(C). Every five years, the Secretary must revise the sanctuary management plan to evaluate the progress made in fulfilling management objectives and assessing the effectiveness of site-specific management techniques and strategies. *Id.* at § 1434(e).

The NMSA makes it illegal for any person to "destroy, cause the loss of, or injure any sanctuary resource managed under law or regulations for that sanctuary." 16 U.S.C. § 1436(1). In addition, federal agency actions that are likely to destroy, cause the loss of, or injure sanctuary resources, including private activities authorized by federal agencies, are subject to consultation under NMSA § 304(d). Under this section, the federal action agency must provide the Secretary of Commerce with a detailed description of the action and its potential effects on sanctuary resources at least 45 days before granting final approval of the action. 16 U.S.C. § 1434(d)(1)(B). If the action is likely to harm sanctuary resources, the Secretary must recommend reasonable and prudent alternatives ("RPA") that the action agency can take to protect sanctuary resources while implementing the project, including undertaking the action in a different location. *Id.* at § 1434(d)(2). Should the action agency fail to follow the RPAs specified by the Secretary and the action results in the destruction, loss of, or injury to sanctuary resources, the action agency must prevent or mitigate further damage in addition to restoring or replacing the damaged sanctuary resources. *Id.* at § 1434(d)(4).

The Secretary's authority to regulate activities within sanctuaries extends to ship traffic. The designation documents for Monterey Bay and Gulf of the Farallones National Marine Sanctuaries provide that "[o]perating a vessel (i.e., water craft of any description) within the Sanctuary" is subject to regulation, including prohibition, to the extent necessary to protect sanctuary resources. 73 Fed. Reg. 70488, 70490 & 70494 (Nov. 20, 2008). Additionally, the designation documents for each of the sanctuaries provide regulatory authority that would prevent taking any marine mammal. 73 Fed. Reg. at 70490, 70491, & 70494; 74 Fed. Reg. 3216, 3219 (Jan. 16, 2009). The Cordell Bank NMS revised designation document does not address the regulation of ship traffic, *see* 73 Fed Reg. at 70491, but it should be modified to do so. While the

Channel Islands NMS designation document generally subjects operation of vessels to regulation, to the extent that it exempts vessels traveling within a Vessel Traffic Separation Scheme or Port Access Route, *see* 74 Fed. Reg. at 3219, Petitioners seek a revision to the designation document to allow regulation of vessels as requested in this Petition to prevent takings of marine mammals and protect sanctuary resources.

B. Other Applicable Authority

1. Endangered Species Act (ESA)

In addition to the authority granted by the NMSA, both the ESA and the Marine Mammal Protection Act give NOAA the authority to promulgate necessary regulations to protect threatened and endangered species and marine mammals from harm associated with ship traffic. Section 11(f) of the ESA authorizes NOAA to "promulgate such regulations as may be appropriate to enforce [the ESA]." 16 U.S.C. § 1540(f). As discussed below, the MMPA similarly authorizes the Secretary to act for the protection of marine mammals. Indeed, these statutes not only authorize NOAA to take action to protect these species, they require it.

The ESA, in particular, requires that agencies give first priority to the protection of threatened and endangered species. *Tenn. Valley Auth. v. Hill*, 437 U.S. 153, 174 (1978) (Supreme Court found "beyond doubt" that "Congress intended endangered species to be afforded the highest of priorities."). Section 2(c) of the ESA establishes that it is "…the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act." 16 U.S.C. § 1531(c)(1). The ESA defines "conservation" to mean "…the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary." 16 U.S.C. § 1532(3). Similarly, section 7(a)(1) of the ESA directs that the Secretary of Commerce review "…other programs administered by him and utilize such programs in furtherance of the purposes of the Act." 16 U.S.C. § 1536(a)(1).

A separate protection afforded by section 9 of the ESA is a prohibition against the "take" of endangered species. 16 U.S.C. § 1538(a); 50 C.F.R. § 17.31(a). "Take" means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. § 1532(19).

The central purpose of the ESA is to recover species to the point where ESA protections are no longer necessary. 16 U.S.C. §§1531(b), 1532(3). To that end, section 4(f) requires that NOAA, through the National Marine Fisheries Service ("NMFS"), both "…develop and *implement* plans (hereinafter…referred to as 'recovery plans') for the conservation and survival of endangered species and threatened species…" 16 U.S.C. § 1533(f) (emphasis added). Consistent with the intent that recovery plans actually be implemented, Congress required that recovery plans "…incorporate…(i) a description of such site-specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species." 16 U.S.C. § 1533(f)(1)(B)(i). As discussed below, slowing ship speeds within NMS borders constitutes a necessary step towards lowering ship strike mortality, noise pollution, and other harms to such critically imperiled species as blue whales and leatherback sea turtles. Such action is necessary both to comply with ESA requirements and to fulfill NMSA goals.

2. Marine Mammal Protection Act (MMPA)

The overriding purpose of the MMPA is to maintain species and populations as functional parts of their ecosystems.

> Such species and population stocks should not be permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystems in which they are a part, and consistent with this major objective, they should not be permitted to diminish below their optimum sustainable population. Further measures should be immediately taken to replenish any species or population stock which has already diminished below that population. In particular, efforts should be made to protect essential habitats, including the rookeries, mating grounds, and areas of similar significance for each species of marine mammal from the adverse effect of man's actions.

16 U.S.C. § 1361(2). Moreover, Congress declared that marine mammals "should be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem." *Id*. at § 1361(6).

To achieve these ends, Congress dictated that Commerce "*shall* prescribe such regulations as are necessary and appropriate to carry out the purposes of [the MMPA]." 16 U.S.C. § 1382(a) (emphasis added). Additionally, for strategic stocks such as the blue whale, Congress explicitly authorized NMFS to "develop and implement conservation or management measures to alleviate . . . impacts" where activities in areas of "ecological significance to marine mammals may be causing a decline or impeding the recovery of the strategic stock." *Id*. at § 1382(e).

In passing the MMPA, Congress explicitly recognized the statute provided a much needed mechanism for regulating vessel traffic that harmed marine mammals. *See* 1972 H.R. Rep. No. 92-707 (1972), reprinted in 1972 U.S.C.C.A.N. 4144, 4147-4150 (noting that "the operation of powerboats in areas where the manatees are found" represented a threat to that species and, absent the new provisions of the MMPA, "at present the Federal government is essentially powerless to force these boats to slow down or curtail their operations." The MMPA "would provide the Secretary of the Interior with adequate authority to regulate or even to forbid the use of powerboats in waters where manatees are found.")[1] *Id.*

In addition to protecting populations of marine mammals, the MMPA also protects individual marine mammals. The primary mechanism by which the MMPA protects marine mammals is through the implementation of a "moratorium on the taking" of marine mammals.

[1] Under the MMPA, the Secretary of the Interior has jurisdiction over manatees while the Secretary of Commerce has jurisdiction over whales. While the species may differ, the provisions of the MMPA apply in the same manner. Additionally, as noted above, the ESA, which was passed a year after the MMPA, also provides NMFS with authority to regulate shipping impacts on endangered marine mammals.

16 U.S.C. § 1371(a). Under the MMPA, the term "take" is broadly defined to mean "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill *any* marine mammal." *Id.*§ 1362(13) (emphasis added); *see also* 16 U.S.C. § 1362(18)(A) (definition of "harassment" expressly applies to acts that affect "a marine mammal or marine mammal stock in the wild") (emphasis added); *Natural Resources Defense Council v. Evans,* 279 F.Supp.2d 1129, 1157 (N.D. Cal. 2002) ("In expressing concern about harassment to 'a marine mammal,' Congress was concerned about harassment to individual animals").

In addition to the moratorium set forth in Section 1371, Congress enacted Section 1372, which makes it unlawful for persons to take any marine mammal. Sections 1372(a)(1) and 1372(a)(2)(A) make it unlawful for "any person . . . vessel or other conveyance subject to the jurisdiction of the United States to take any marine mammal on the high seas" or "in waters or on lands under the jurisdiction of the United States." Section 1372(a)(2)(B) prohibits persons from "using any port, harbor, or other place under the jurisdiction of the United States to take or import marine mammals or marine mammal products."

For species like the blue whale, for which take of more than two animals a year exceeds the potential biological removal level[2] (NMFS 2009), extra protection from ship strikes and noise within the NMS borders could contribute significantly to continued survival and recovery. As detailed below, slowing ship traffic within the marine sanctuaries off the California coast would help to ensure that these areas fulfill their role as true sanctuaries for protected species and is necessary to protect numerous marine mammal and other protected species from multiple adverse effects associated with shipping.

3. National Ocean Policy

On June 12, 2009, President Obama issued a memorandum establishing an Interagency Ocean Policy Task Force and directing the Task Force to develop a national ocean policy that would protect, maintain, and restore ocean resources, prioritize upholding stewardship responsibilities, and provide for coordination of local, state, and federal management of ocean resources (CEQ 2009a). The Task Force's Final Recommendations emphasize the need to use marine spatial planning to reduce conflicts between uses of ocean resources and enhance protection of special ocean resources (CEQ 2010). The report also emphasizes the need for coordination of local, state, and federal management measures. Finally, the report notes that management of ocean resources must be based on sound science and the precautionary principle (*id.*). In other words, science must guide management decisions and, when complete or reliable science is lacking, management measures should err on the side of protecting sensitive resources (*id.*).

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[2] Under the MMPA, the potential biological removal level is "the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population." *See* http://www.nmfs.noaa.gov/pr/glossary.htm#p. Exceeding that number of animals by unnatural mortalities, as defined by the MMPA, may prevent that stock from maintaining its optimum sustainable population.

The Task Force's *Interim Framework for Effective Coastal and Marine Spatial Planning* highlights efforts to reconfigure ship traffic patterns leading into Boston Harbor in order to reduce collisions between commercial vessels and whales, particularly the critically endangered North Atlantic right whale. The report summarizes the success of these coordinated efforts:

> Comprehensive planning enabled the National Oceanic and Atmospheric Administration (NOAA), United States Coast Guard, and several other government agencies and stakeholders to examine shipping needs, proposed deepwater liquefied natural gas port locations, and endangered whale distribution in a successful effort to reconfigure the Boston Traffic Separation Scheme (TSS) to reduce the risk of whale mortality due to collisions with ships in the Stellwagen Bank National Marine Sanctuary. The reconfigured TSS reduced risk of collision by an estimated 81% for all baleen whales and 58% for endangered right whales. Industry TSS transit times increased by only 9 – 22 minutes (depending on speed) and conflict with deepwater ports was eliminated. In addition, the new route decreased the overlap between ships using the TSS, commercial fishing vessels, and whale watch vessels, thereby increasing maritime safety. CMSP has the significant potential of applying this integrated, multi-objective, multi-sector approach on a broader, sustained scale.

(CEQ 2009b at 4).

The same sort of coordinated effort to protect sanctuary resources off the California coast is both necessary and feasible. As discussed below, NOAA has a unique opportunity to build upon and coordinate with existing efforts to reduce commercial vessel speed off the California coast and, in doing so, to achieve important improvements in air quality and marine resource protection.

II. NATIONAL MARINE SANCTUARIES OFF THE CALIFORNIA COAST

The four Pacific coast national marine sanctuaries off the coast of California are managed by ONMS via the individual sites with the assistance of the Sanctuary Advisory Councils and the West Coast Regional Office of the NMS Program in Monterey, California (http://sanctuaries.noaa.gov/visit/westcoast.html).

A. Channel Islands

The Channel Islands NMS encompasses the waters surrounding Anacapa, Santa Cruz, Santa Rosa, San Miguel, and Santa Barbara Islands, extending from mean high tide to six nautical miles from the shore of each of the islands. In all, the sanctuary includes 1,252 square nautical miles within the Santa Barbara Channel (http://channelislands.noaa.gov/focus/about.html).

This area was designated a NMS in 1980 because of its unique natural resources. The Sanctuary is home to a wealth of marine life, thanks to its mosaic of kelp forest rock bottom and sand bottom habitats and geographic locations along important migratory corridors. Occupying a distinct hydrogeographic bioregion between two different ocean currents (Oregonian Province and California Province), Sanctuary waters are highly productive and host a wealth of marine mammals that are uniquely prevalent in the Channel Islands NMS including a plethora of fish, invertebrates, sea birds and other organisms. Of particular importance are the eighteen species of whales and dolphins that are considered residents of the Sanctuary and four species of pinnipeds that have breeding habitat there (http://channelislands.noaa.gov/animals/animals.html). An additional nine cetacean species have been sighted in the Sanctuary. Whale watching is a popular activity because of the variety of large baleen and toothed whales found in and around the Channel Islands NMS including: blue whales (*Balaenoptera musculus*), gray whales (*Eschrichtius robustus*), humpback whales (*Megaptera novaeangliae*), killer whales (*Orcinus orca*), minke whales (*Balaenoptera acutorostrata*), fin whales (*Balaenoptera physalus*), sperm whales (*Physeter macrocephalus*), and right whales (*Eubalaena glacialis*). Of these whales, five species are listed as endangered under the ESA including: blue, gray, humpback, fin, and sperm whales. Additional information about the presence and feeding habits of each species in and around the Sanctuary is provided below.

Between June and November, high densities of endangered blue whales spend time feeding on the abundant planktonic krill found in the Channel Islands NMS. In fact, blue whales have developed a particular affinity for the area such that the Santa Barbara Channel hosts the world's densest summer seasonal congregation of blues. Another endangered whale, the humpback whale, congregates in the Sanctuary from May to September. Little is known about the elusive endangered fin whales; however, congregations have been observed near feeding aggravations of blue and humpback whales. Endangered sperm whales are rare in the Santa Barbara Channel but there have been at least two stranding of sperm whales on the northern Channel Islands indicating that they use the waters around the Sanctuary. The endangered right whale is also extremely rare in the area with only one sighting reported in the Santa Barbara Channel in 1981. While relatively uncommon, killer whales have been observed in the Sanctuary feeding on gray whales, pacific harbor seals, California sea lions, and fish.[3] Gray whales migrate through the sanctuary in the late fall on their way south to breeding grounds and again in the late winter and early spring on their way north to feeding areas. On the northern migration, gray whale mother-calf pairs are often observed traversing the Sanctuary. Minke whales are known to occupy the region year-round. They have been observed in higher abundance from late spring through early summer (ONMS 2009a).

The Sanctuary's primary purpose is the protection of the natural and cultural resources contained within its boundaries. 74 Fed. Reg. at 3218. Toward that end, the Channel Islands NMS regulations prohibit "[t]aking any marine mammal, sea turtle, or seabird within or above the Sanctuary," except as authorized by the MMPA, ESA, or Migratory Bird Treaty Act (15 C.F.R. 922.72(a)(9).)

In addition, vessels are prohibited from operating within one nautical mile of any Island. This prohibition extends to "any vessel engaged in the trade of carrying cargo, including, but not limited to, tankers and other bulk carriers and barges, any vessel engaged in the trade of servicing offshore installations, or any vessel of three hundred gross registered tons or more,"

[3] The killer whales that visit the area are part of the transit population of killer whales and are not part of the Southern resident population that are listed as endangered.

except fishing or kelp harvesting vessels, and except to transport persons or supplies to or from any Island (15 C.F.R. § 922.72(a)(6)).

B. Monterey Bay

Monterey Bay NMS is the nation's largest marine sanctuary, stretching 276 miles along the central California coastline from Marin to Cambria and encompassing 5,322 square miles of ocean. Designated in 1992, its unique natural resources include the largest kelp forest in U.S. waters, one of North America's largest underwater canyons, the nation's most nearshore deep ocean environment, 33 species of marine mammals, 94 species of seabirds, 345 fish species, and a multitude of plants and invertebrates (http://montereybay.noaa.gov/intro/welcome.html).

The central coast of California is one of only five regions of the world where major upwelling produces prime whale habitat, particularly in the immediate vicinity of the Monterey Submarine Canyon (http://montereybay.noaa.gov/visitor/whalewatching/welcome.html). Gray whales migrate through the Monterey Bay NMS, within three kilometers of the coastline, in the winter and spring months (*id.*). The Eastern North Pacific population of gray whales is increasingly birthing calves during their southbound migration through this section of the California coast, with 50 percent of calves now assumed to be born north of Carmel, California (Shelden *et al*. 2004). Thousands of blue whales come to the Sanctuary in the summer and fall months to feed off the area's dense swarms of krill, and humpback whales populate the Sanctuary in the fall (http://montereybay.noaa.gov/visitor/whalewatching/welcome.html). Other commonly sighted cetaceans include minke whales, Pacific white-sided dolphins, Risso's dolphins, northern right whale dolphins, common dolphins, killer whales, Dahl's porpoises, fin whales, harbor porpoises, bottle-nosed dolphins, and beaked whales (*id.*).

Despite the unique wealth of marine wildlife in this sanctuary, there are currently no provisions mitigating the threats posed by commercial vessel traffic in Monterey Bay NMS waters. *See* 15 C.F.R. § 922.132.

C. Gulf of Farallones

The Gulf of the Farallones NMS was designated in 1981. It encompasses 948 square nautical miles west of San Francisco, including the Gulf of the Farallones as well as Bodega Bay, Tomales Bay, Estero de San Antonio, Estero Americano, and Bolinas Lagoon (http://farallones.noaa.gov/about/welcome.html). The Sanctuary serves as a breeding ground and nursery for elephant seals, harbor porpoises, Pacific white-sided dolphins, 52 species of rockfish, 20 percent of California's harbor seals, and 400,000 seabirds. Thirty-six marine mammal species and 27 federally threatened or endangered species have been sighted in the Gulf of the Farallones NMS, which is also home to one of the last remaining populations of Stellar sea lions, one of the largest remaining populations of blue whales, and one of the highest concentrations of white sharks (*id.)*. The major migration route of the Eastern North Pacific gray whale passes through the Sanctuary, which also serves as prime feeding grounds for migrating birds and humpback whales.

In order to protect the unique natural resources of the Gulf of the Farallones NMS, non-fishing commercial vessel traffic is prohibited "within an area extending 2 [nautical miles] from the Farallon Islands, Bolinas Lagoon, or any ASBS [area of special biological significance]." 15 C.F.R. § 922.82(a)(4). This prohibition covers "any vessel engaged in the trade of carrying cargo, including but not limited to tankers and other bulk carriers and barges, or any vessel engaged in the trade of servicing offshore installations." *Id.* Additionally, there are regulations that address other wildlife disturbance restricting, for example, aircraft overflights at less than 1,000 feet. 15 C.F.R. § 922.82.

D. Cordell Bank

The Cordell Bank NMS, established in 1989, encompasses 529 square miles surrounding the offshore granitic Cordell Bank and extending north and west of the Gulf of the Farallones NMS (http://cordellbank.noaa.gov/sanctuary/welcome.html). This unique area serves as one of the most important feeding grounds in the world for endangered blue and humpback whales. It is home to 246 fish species and 24 other species of marine mammals, including Pacific white-sided dolphins, elephant seals, northern fur seals, California sea lions, and Stellar sea lions (http://cordellbank.noaa.gov/environment/bio_res.html). Five of the 14 albatross species frequent the Sanctuary, which is dubbed "the albatross capital of the northern hemisphere" (*id.*).

Commercial vessel traffic in Cordell Bank NMS waters is largely unregulated, despite the serious threats it poses to Sanctuary resources. *See* 15 C.F.R. § 922.111.

III. IMPACTS OF SHIP SPEED AND BENEFITS OF SPEED REDUCTION

A. Ship Strikes on Marine Mammals

1. Ship Strikes Are a Major Cause of Marine Mammal Injury and Mortality.

Ship strikes involving large vessels are the "principal source of severe injuries to whales" (Laist *et al*. 2001 at 58). Most ship strikes to large whales result in death (Jensen and Silber 2003, Figure 4). Jensen and Silber (2003) documented 292 confirmed or possible ship strikes between 1975 and October 2002. The U.S. west coast was second only to the U.S. east coast in reported North American collisions (*id.* at Figure 3). Douglas *et al*. (2008) and others speculate that, since whales killed in water deeper than 1,000 meters are unlikely to surface after death, whale mortalities off the U.S. Pacific coast may be under-reported due to the shallow continental shelf and the closer proximity of deep water to the coast (relative to the East Coast) (Douglas *et al.* 2008 at 10). The type of vessel most frequently involved in collisions was navy ships, for which ship strike reporting is mandatory; cargo/container ships were the second most frequently involved category of ship (*id.* at Figure 5).

a) Ship traffic off the U.S. Pacific Coast

U.S. ports and waterways handle two billion tons of cargo annually – a total that is expected to double by 2020 (http://www.aapaports.org/Industry/content.cfm?ItemNumber=1022&navItemNumber=901). A significant portion of this cargo is shipped to or from the dozens of ports dotting the U.S. Pacific coast. The Ports of Los Angeles and Long Beach are the most active of any U.S. port, with thousands of large vessels arriving each year, and San Francisco Bay Seaport is the fourth busiest container port in the U.S. (http://www.portofoakland.com/portnyou/overview.asp). As a consequence, shipping lanes off the U.S. Pacific coast are among the busiest in the world. Ship traffic along the California coast is increasing (Berman-Kowalewski *et al.* 2010).

The overlap of these shipping lanes with California's national marine sanctuaries puts sanctuary wildlife at great risk. While we cannot likely change the behavior of whales and other species so as to avoid ship strikes, we can and must regulate vessel practices to minimize this risk. The Gulf of the Farallones and Cordell Bank National Marine Sanctuaries have convened working groups to identify the effects of vessel traffic on the sanctuary resources. There must also be affirmative and mandatory measures to reduce vessel interactions with whales.

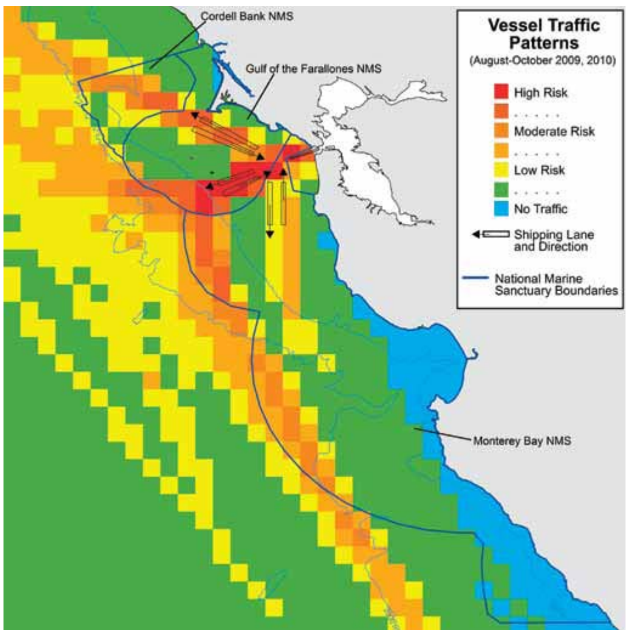


Figure 3. Risk posed by vessels to cetaceans based on vessel traffic data in 2009 and 2010. (Source: Keiper *et al.* 2011.)

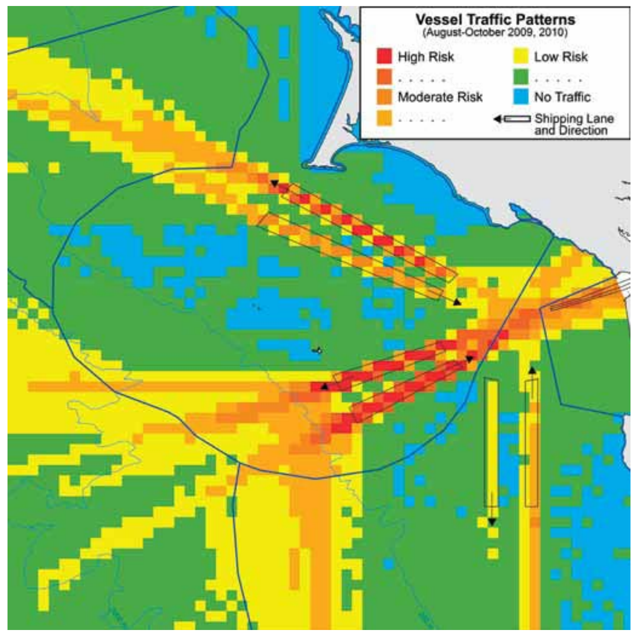


Figure 4. Risk posed by vessels to cetaceans based on vessel traffic data in 2009 and 2010. (Source: Keiper *et al.* 2011.)

b) *Documented collisions between ships and whales*

Ship strike-related mortality is a documented threat to endangered Pacific coast populations of endangered fin, humpback, blue, sperm, and killer whales. Ship strikes are an increasing problem in California (Zito 2010). Since 2001, nearly 50 large whales off the California coast were documented as having been struck by ships (NMFS 2010c). In 2010 alone, at least six large whales were reported victims of collisions with vessels (*id.).* Three blue whales and a fetus were struck by ships in or near marine sanctuaries, a gray whale in Los Angeles harbor, a humpback near the Farallon Islands, and a fin whale at Ocean Beach, San Francisco (*id.).* Additionally, on September 16, 2010, a fin whale arrived on a ship bow at Port of Oakland (Kuruvila 2010), and on May 8, 2011, a humpback whale was found washed ashore at San Pedro, CA. Though the causes of death were unknown for these two whales, experts believe they are likely attributable to ship strikes (*See, e.g.,* LA Times, May 8, 2011, "Remains of humpback whale wash ashore in San Pedro"). As discussed below, in September 2007, five blue whale deaths near the Channel Islands NMS were attributed to ship strikes (Abramson *et al.* 2011).

Blue whales. In recent years, ship strikes have become an increasing problem for this critically endangered species. Between 2001 and 2010, 12 blue whales were reported stranded due to vessel collisions (NMFS 2010c). In 1998, NMFS identified ship strikes as one of the primary threats to the endangered blue whale in the Pacific.

> Ship strikes were implicated in the deaths of at least four and possibly six blue whales off California between 1980 and 1993 (Barlow *et al*. 1995; Barlow *et al*. 1997). The average number of blue whale mortalities in California attributed to ship strikes was 0.2 per year from 1991-1995 (Barlow *et al*. 1997). Further mortalities of this nature probably have occurred without being reported. Several of the whales photo-identified off California had large gashes on the dorsal body surface that were thought to have been caused by collisions with vessels (Calambokidis 1995).

(NMFS 1998 at 12). According to the most recent stock assessment report, "[s]hip strikes were implicated in the deaths of five blue whales, from 2003-2007" (NMFS 2009 at 180). In 2003, a blue whale was documented injured (blood in the water) from a ship strike (*id*.). Additional mortality is also underreported because the whales do not strand, and photographs have documented several blue whales in California with large gashes from ship strikes (*id.*). The average minimum number of blue whale mortalities and serious injuries from 2003-2007 increased to 1.2 per year (*id.*).

In 2007, there was a significant increase in the number of blue whale deaths attributed to ship strikes. According to a report compiled for the Channel Islands NMS:

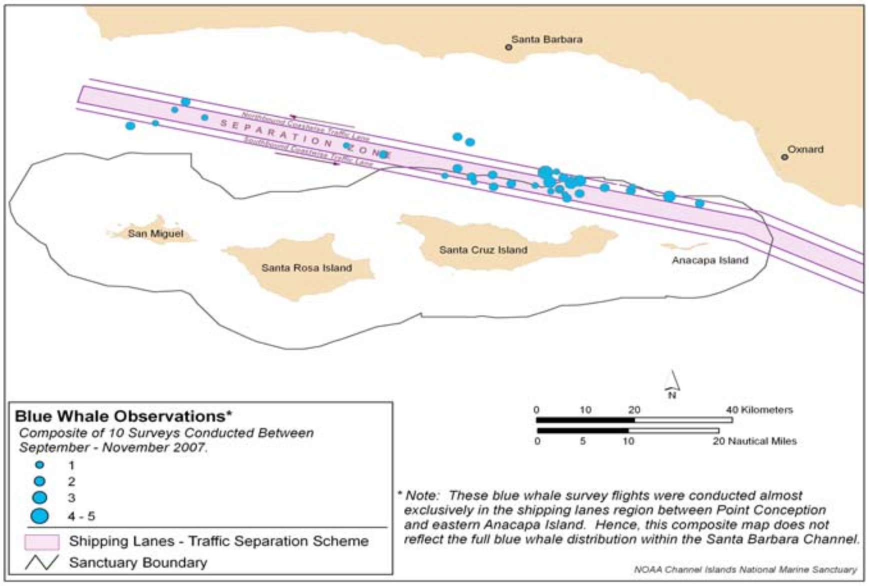
> During September of 2007, NOAA received reports of 5 blue whale carcasses between Santa Cruz Island and San Diego. Historically, the maximum number of blue whale documented fatalities in a single year in the region was three, occurring in both 1988 and 2002. NOAA's National Marine Fisheries Service (NMFS) designated the blue whale mortalities as an "Unusual Mortality Event" on October 11, 2007, recognizing that the observed mortalities had met one or more criteria for the declaration of a UME (Hogarth 2007). The first animal was brought into port on the bow of a large ship and necropsies on two of the other whales found floating in the Santa Barbara Channel appeared to confirm ship strike as the cause of death. Two additional blue whale carcasses, an adult female and a very young individual (believed to be a fetus expelled after stranding of the adult) were discovered on San Miguel Island on November 29. Though the San Miguel carcasses were several weeks old, it was determined that the adult had injuries consistent with those sustained in a collision with a large vessel, and that the calf likely died as a consequence of its mother being struck and killed (Lecky 2008).

(Abramson *et al.* 2011: i.). Although NMFS deemed the large number of ship strikes in 2007 "anomalous," (Letter from James Lecky, NOAA, Response to Petition from the Center for Biological Diversity to Implement Emergency Regulations in Southern California to Protect Blue Whales, Jan. 8, 2008), it is clear that documented ship strikes on blue whales and other species have become an all-too-regular occurrence in the years since then. It is also clear that more whales are likely injured or killed than are observed. As NMFS has identified in its recovery plans and stock assessments for blue and other whales, minimizing the number of whales that are injured or killed due to ship strikes is vital for the species survival and recovery.

Berman-Kowalewski *et al.* (2010) suggest that “ship strike is an important cause of blue whale mortality along the California coast, and a spatial and temporal cluster in 2007 raised concerns about factors predisposing blue whales to this event.” Surveys conducted in response to these strandings revealed unexpected and significant numbers of blue whales in the shipping lanes during the fall months (*see* Figure 3, below; *see also* Berman-Kowalewski *et al.* 2010: “In addition to more whales being in the vicinity of the Santa Barbara Channel in fall 2007, there were also some indications that blue whales were distributed within the shipping lanes more than in previous years.”). As Berman-Kowalewski noted, the data “indicate that blue whales are susceptible to mortality from ship strikes off the coast of California during their seasonal association with the area, particularly when krill occur in the shipping lanes” (*id*.).

The fall of 2009 saw another spike in blue whale deaths when, in a period of only two weeks, two blue whales were killed by ship strikes. In early October, a blue whale washed ashore in Monterey County after being struck by a ship. Not long after this, another blue whale collided with a research vessel off the coast of northern California and washed up at Ft. Bragg (NMFS 2010c). This collision was unusual in that the vessel was traveling at low speed, but nevertheless shows the damage that even moderately sized vessels can inflict on large whales.

Figure 5. Blue Whale Observations in a Portion of the Santa Barbara Ship Channel, September – November 2007.
(Source: NMFS,http://channelislands.noaa.gov/focus/alert.html)[4]



In 2010, there was an unusually large number of blue whale sightings off of the coast of California due to abundant krill (Sahagun 2010, Zito 2010). Whale mortalities spiked as foraging whales gathered in busy shipping lanes off the coast (Zito 2010). Changing ocean conditions can influence the productivity in the California Current system and change the abundance of prey for whales. Therefore, more blue whales may be at risk due to changing ocean conditions.

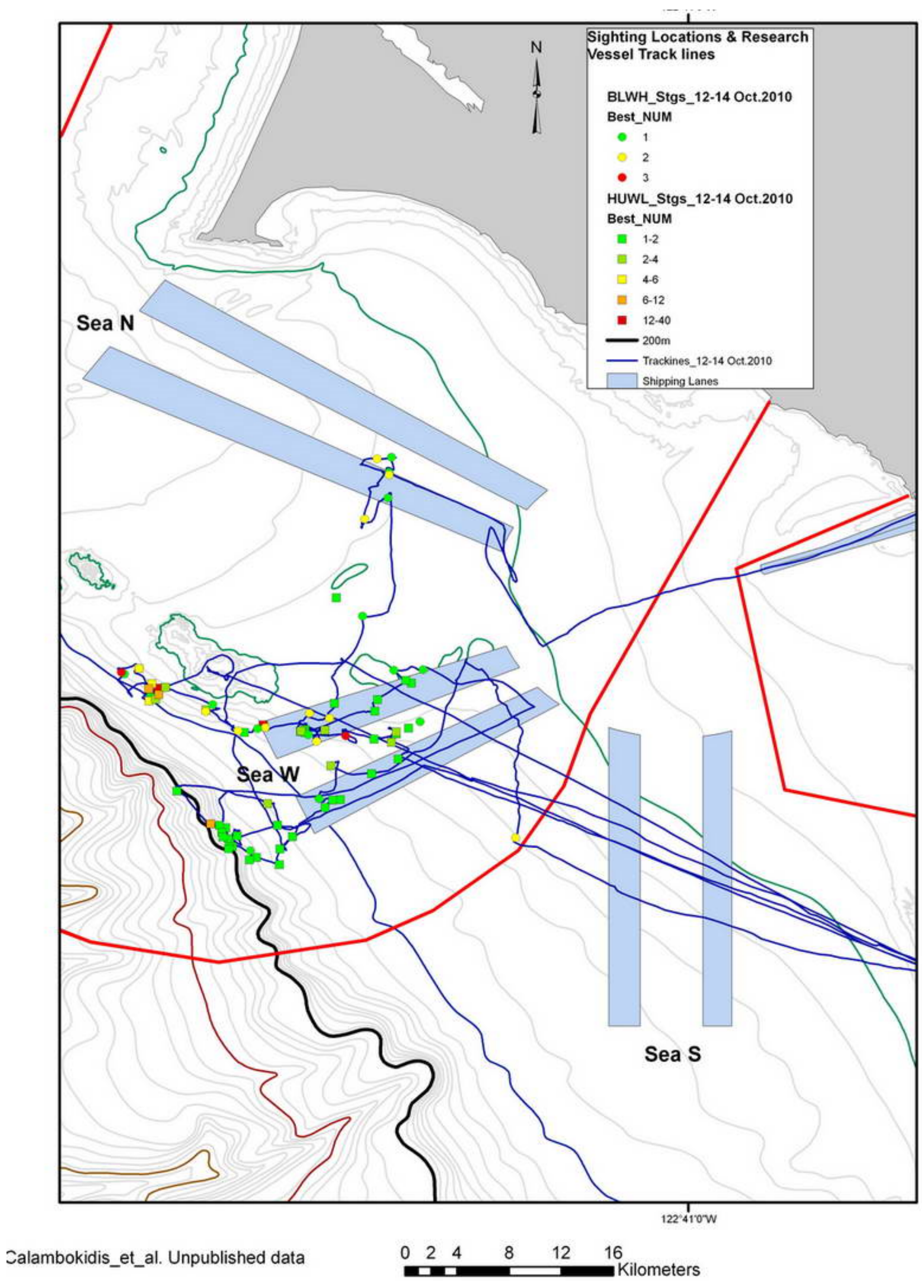
Fin whales. These large and fast whales, which are routinely sighted in National Marine Sanctuary waters off the U.S. Pacific coast, were the most frequently struck species in the analysis conducted by Jensen and Silber (2003, 75 confirmed strikes, 26 percent of total strikes). At least 18 fin whale mortalities and injuries due to ship strikes were conclusively documented off the coasts of California, Oregon, and Washington between 1993 and 2008 (NMFS 2010a at I-26). In their examination of 130 whale strandings in Washington State from 1980-2006, Douglas *et al*. (2008) found fin whales to be the species most susceptible to ship strikes. Between 2001 and 2010, six fin whales have been reported killed by ship strikes, and all but one of those was off the southern California coast (NMFS 2010c). The final recovery plan for fin whales ranks the threat posed by ship strikes as "potentially high" (NMFS 2010a at I-26).

Humpback whales. In its 1991 draft recovery plan, NMFS acknowledged the significant and increasing threat to humpback whales where major shipping lanes and important feeding grounds intersect, including in the Gulf of the Farallones (NMFS 1991 at 26). Jensen and Silber documented 44 confirmed collisions between ships and humpbacks between 1975 and 2002, making them the second most frequently struck species in their survey (Jensen and Silber 2003 at

[4] This chart, however, underestimates whale presence because it only includes "opportunistic" sightings.

2). Between 2005 and 2010, reports show that at least six humpback whales were stranded due to vessel collisions (NMFS 2010c).

Figure 6. Locations of humpback and blue whales sighted 12-14 October 2010 along with vessel effort tracks for same period in relation to shipping lanes.
Map prepared by Carol Keiper, Oikonos using data from Cascadia Research (available at http://www.cascadiaresearch.org/update_on_california_ship_strike-13Oct10.htm)



Other whale species. Other cetaceans, including gray whales, sperm whales, and Southern resident killer whales, are also victims of ship strikes. Eastern North Pacific Gray whales migrate along the California coast to and from their feedings grounds in the Bering and

Chukchi Seas and their calving and nursery grounds in Baja California. [5] In April 2009, sightings confirmed the death of a juvenile gray whale from a ship strike off Orange County (NMFS 2010c).

The final recovery plan for sperm whales characterizes them as vulnerable to ship strikes because they "spend long periods (typically up to 10 minutes) 'rafting' and socializing at the surface between deep dives" (NMFS 2010b at I-35). While the final recovery plan indicates that ship strikes are likely not a significant threat to sperm whales, it also indicates that the "possible impact of ship strikes on recovery of sperm whale populations is not well understood" (NMFS 2010b at I-35) and that "the offshore distribution of sperm whales may make ship strikes less detectable than for other species" (NMFS 2010b at IV-16).

The draft recovery plan for southern resident killer whales documents rare but increasing cases of collisions between ships and individuals of that distinct population segment (NMFS 2008a at II-45, II-49), which was listed as endangered in 2005. 70 Fed. Reg. 69903 (Nov. 18, 2005).

c) *Reducing ship strikes has been deemed a priority for recovery of whale populations*

Recovery plans for ESA-protected whale species specifically recommend actions to identify areas where ship strikes occur and to take appropriate action to reduce or eliminate such impacts. For example, the blue whale recovery plan includes the following recommendations:

> 4.1 Identify areas where ship collisions with blue whales might occur, and areas where concentrations of blue whales coincide with significant levels of maritime traffic or pollution.
>
> 4.2 Identify and implement methods to reduce ship collisions with blue whales.

(NMFS 1998). The recovery plan concludes that "implementation of appropriate measures designed to reduce or eliminate such problems are essential to recovery" and that such actions "must be taken to prevent a significant decline in population numbers." (*id*. at 36). Similarly, the final recovery plans for the sperm whale (NMFS 2010b at IV-4, V-9) and the fin whale (NMFS 2010a at IV-3, V-13) recommend research and protective measures to reduce ship strikes as top priorities, as does the 2008 recovery plan for Southern resident killer whales (NMFS 2008a at V-2). The recovery plans for fin and sperm whales further recommend, with regard to the need for

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[5] An extremely endangered Western North Pacific gray whale was tracked traveling along the California coast in early 2011, surprising scientists who have long assumed that the two extant gray whale populations are geographically distinct and do not intermingle (*see* http://mmi.oregonstate.edu/sakhalin2010Map; http://www.iucn.org/wgwap/?7015/Western-gray-whale-makes-unexpected-journey). "While previous studies have supported genetic differentiation between eastern and western populations of gray whales, the relatively low level of genetic differences observed at nuclear markers suggests that some dispersal between the two populations could be occurring. The finding of two whales apparently sampled on both sides of the North Pacific, although subject to numerous caveats, provides support for that possibility" (Lang *et al.* 2010, cited in http://cmsdata.iucn.org/downloads/movements_of_western_gray_whales_from_the_okhotsk_sea_to_the_eastern_north_pacific.pdf).

ship strike reduction, that "[m]ethods and measures developed for other endangered whales (*e.g.*, right whales) should be considered for their possible application to fin whales" (NMFS 2010a at IV-3; NMFS 2010b at IV-17) and note the expected benefits of existing east coast ship speed restrictions for both fin and sperm whale populations in that region (NMFS 2010a at I-26; NMFS 2010b at I-35).

2. Correlation Between Vessel Speed and Ship Strikes

Scientific research has shown that there is a direct correlation between vessel speed and ship strikes resulting in whale mortality (Laist, *et al*. 2001, Pace and Silber 2005, Vanderlaan and Taggart 2007, Panigada *et al.* 2006, Silber *et al.* 2010). Ship speed affects the likelihood of whale mortality in two ways. First, slower ship speeds provide whales with a greater opportunity to detect the approaching ship and avoid being hit by it. "To the extent that increasing vessel speed significantly increases accelerations experienced by a whale, limits on vessel speed will reduce the magnitude of the acceleration; may increase response time for a whale attempting to maneuver away from a vessel; and appear to be reasonable actions to consider in policy decisions aimed at reducing the overall threat of ship strikes" (Silber *et al.* 2010).

Second, research shows that whales that are hit by slower moving ships are less likely to suffer serious injury or death. While slower speeds may not avoid all collisions between whales and ships, research shows that collisions at slower speeds are less likely to result in serious injury or death of the whale that has been struck. Laist *et al*. (2001) reported in a historical analysis of ship strikes involving large cetaceans that:

> Among collisions causing lethal or severe injuries, 89% (25 of 28) involved vessels moving at 14kn or faster and the remaining 11% (3 of 28) involved vessels moving at 10-14 kn; none occurred at speeds below 10 kn (Laist *et al*. 2001 at 49).

In this study, none of the whales hit at a speed of 10 knots or less were killed. Vanderlaan and Taggart (2007) report that "as vessel speed falls below 15 knots, there is a substantial decrease in the probability that a vessel strike to a large whale will prove lethal" (Vanderlaan and Taggart 2007 at 152), but that only at speeds slower than 11.8 knots does the chance of a fatal injury to a large whale drop below 50 percent (*id*. at 149). Pace and Silber (2005) noted that they found "clear evidence of a sharp rise in mortality and serious injury rate with increasing vessel speed." Specifically, they found that probability of serious injury or mortality increased from 45 percent at 10 knots to 75 percent at 14 knots, exceeding 90 percent at 17 knots (*id*.).

Questions remain as to how whales perceive the sounds of approaching vessels. Because whales may sometimes have difficulty detecting the direction of an approaching ship, it is particularly important to give them extra time to avoid collision as well as a better chance of surviving a collision if the worst does occur. In a letter published in *Marine Mammal Science*, Terhune and Verboom (1999) explained that external factors such as bathymetry and sound refraction may have significant influence on how right whales perceive ship noise. There is an apparent contradiction observed in right whales that sometimes seem unaware of an approaching vessel, regardless of the ship noise.

> If a right whale is swimming at mid-depth and hears an approaching ship, it will have difficulty in locating the direction of the ship because of the echoes off the bottom and surface. The loudness will not necessarily indicate how far away the ship is. If the whale then swims toward the surface directly ahead of the ship, the sound levels of that particular ship will become lower because of the downward diffraction, the Lloyd-mirror effect, near-field effects, and possible shielding from the hull. Furthermore, while breathing at the surface, the auditory bullae of a right whale will be about 1 m deep and this proximity to the surface will enhance the above effects. Thus, in terms of the acoustic stimulus associated with an approaching vessel, the quietest location will likely be at the surface, directly ahead of the ship (Terhune and Verboom 1999 at 257).

Terhune and Verboom (*id.*) recommended that to avoid striking right whales, the ship operators need to take evasive actions to avoid collisions. However, this is rarely practicable, especially for very large vessels. Since successfully avoiding a collision depends in part on accurately predicting a whale's movement, the ship operator may not be able to manoeuvre a large vessel in such a way that a collision is successfully avoided. Slower moving vessels may provide more time for a whale to avoid being struck. Laist *et al.* (2001) report situations in which a last-second flight response on the whale's part may serve to avoid collisions. Studies suggest that slower moving vessels are easier for whales to avoid, even if acoustic signals were missed (NMFS 2008b at 4-7 – 4-8).

Indeed, after reviewing various mechanisms for preventing Atlantic right whale deaths from ship strikes, NMFS concluded that a mandatory speed limit for large vessels was imperative. Ship strikes are one of two major causes of right whale death off the U.S. east coast and, combined with mortalities caused by entanglement in fishing gear, have driven the species to near-extinction. In determining how to reduce ship strikes, NMFS examined operational measures including designated ship routes, dynamic management areas where certain voluntary speed limit restrictions of 10 knots would go into effect if and when right whales were detected there, and seasonal management areas where a mandatory speed limit of 10-knot or less has been imposed. NMFS found that no other measure was as essential or effective as the establishment of a mandatory 10-knot speed limit (NMFS 2008b at 4-3 to 4-15). NMFS found that instituting this speed limit would also benefit other whales, such as humpback, fin, sperm, and sei whales, as well as sea turtles (*id.* at 4-19, 4-23).

California hosts some of the busiest ports in the world, meaning that large commercial vessels regularly speed through these waters on their way to port. After analyzing the whale strikes in the vicinity of the Santa Barbara Channel in 2007, Berman-Kowalewski et al recommended that "mitigation measures developed for other species should be considered for blue whales off the California coast if further mortality is to be reduced" (Berman-Kowalewski 2010). In 2009, the Channel Islands NMS Advisory Council adopted several recommendations to reduce the risk of ship strikes in the Santa Barbara Channel region, including ship speed limits and special management areas (Abramson *et al.* 2011).

As discussed further in Section IV, clear, mandatory vessel speed limits are a critical mechanism for reducing serious injury and mortality of whales from ship strikes. Establishing a mandatory 10-knot speed limit within the sanctuaries off the California coast is a necessary way to protect magnificent sanctuary resources like the blue whale, humpback whale, fin whale, leatherback sea turtle, and other wildlife. Moving shipping lanes away from areas of high whale concentrations is another mechanism to reduce whale and ship conflicts; however, only reducing ship speeds will have the additional benefits of reducing mortality from collisions and decreasing acoustic noise (see Ocean Noise Pollution section below).

B. Ocean Noise Pollution

1. Shipping Is a Major Source of Ocean Noise Pollution

Over the last 50 years, there has been a dramatic increase in ocean noise pollution from human sources including navy active sonar, seismic surveys used for research and oil and gas exploration, and commercial shipping (Hildebrand 2005). Vessel traffic is the largest source of noise pollution in the marine environment (Hildebrand 2005). The national marine sanctuaries described above are impacted by this form of transboundary energy pollution primarily as vessels use shipping lanes to access the ports inside the San Francisco Bay or as they pass through the area on route to the ports in Southern California and the Pacific Northwest. Due to the transboundary nature of noise, ships traveling outside the sanctuaries could also have an impact within the sanctuaries. The intense, low frequency noise pollution generated by ships can travel great distances through the water (Hildebrand 2005).

Noise pollution from shipping results primarily from the formation and collapse of air bubbles as the propeller turns. This process, known as cavitation, creates very loud acoustic pollution in the same lower-frequency range used for communication by whales, dolphins and other marine animals (Hildebrand 2005). Cavitation is the primary source of noise at high speeds (Arveson 2000). As a result, one of the most efficient ways to reduce noise from cavitation is to reduce the speed of the vessel. Because cavitation also reduces fuel efficiency, reducing speed could also reduce the fuel costs for operating large commercial shipping vessels (Haren 2007).[6]

a) Omnipresent Hum

Ocean noise pollution, predominantly from large shipping vessels, has created an "omnipresent hum" in our ocean. Large commercial shipping vessels are the primary source of anthropogenic low-frequency sound contributing to ambient (background) noise in the ocean. Because very loud low-frequency sound can travel great distances in the deep ocean, increasing noise impacts areas far beyond the source of the noise (Hildebrand 2005).

Studies have found that the ambient noise levels in the ocean are rapidly increasing with the size of the global shipping fleet. One study measuring ambient noise levels in the Pacific Ocean off the coast of California showed that noise levels from shipping have doubled every decade for the last 40 years (McDonald *et al*. 2006). This trend of increasing noise pollution corresponds with a dramatic expansion of the global commercial fleet, which has doubled in the last four decades, and the gross tonnage transported has nearly quadrupled from 1965 to 2003

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[6] According to the International Maritime Organization, reducing vessel speed by just 3 knots can reduce power needs by about 35 percent (IMO 2000).

(*id.*). Global shipping activity, as measured in metric ton-kilometers, has increased by five percent per year for the last three decades (*id.).* This rate of growth is projected to increase (*id.)*.

Tests conducted near San Nicolas Island, one of the Channel Islands just south of the Channel Islands NMS, indicate that ambient noise pollution in that area has increased by 10-12 decibels over the past 40 years. McDonald *et al*. (*id.*) suggest that this increase, potentially reflected throughout the Northeast Pacific, is most likely due to changes in commercial shipping. The Sanctuary Advisory Council (SAC) for the Channel Islands NMS has recognized the following:

> large vessel traffic (defined as ships 85m and longer) represents the preeminent source of anthropogenic noise and the primary acoustic threat to Sanctuary resources. . . Traffic volume is a factor of the geographic location of the Sanctuary vis-à-vis major commercial ports such as Los Angeles/Long Beach and San Francisco, and the continuing growth of international trade, specifically between the US and Asia, which depends enormously on ship transport.

(Polefka 2004 at 3-4).

b) International Efforts to Reduce Ship Noise Pollution

The International Maritime Organization (IMO) is presently considering ways to minimize ship noise pollution in order to reduce potential adverse impacts on marine life. In particular, the committee will develop voluntary technical guidelines for ship-quieting technologies as well as potential navigation and operational practices (US 2008). Technical submissions by the United States, as well as Australia, were primarily responsible for the establishment of this issue as a work item for the committee (*see also* US 2007, US 2009). Efforts regarding the issues of ship speed and noise pollution are ongoing at the Organization.

2. Threats to Sanctuary Resources from Ocean Noise Pollution

Ocean noise pollution has a range of impacts on marine life (*see, e.g.,* Andre *et al.* 2011, Polefka 2004). At worst, it can be deadly (*id.*). Exposure of animals to intense and/or continuous noise pollution can also trigger behavioral changes, mask biologically important sounds, interfere with foraging efforts, and increase vulnerability to predators and ship strikes. Noise-related stress can lead to disruptions in feeding, mating, and migration and may trigger an abandonment of habitat. Noise pollution can make it more difficult for fish and marine mammals to locate food and mates, avoid predators, navigate, and communicate (Popper 2003). Hearing damage resulting from noise exposure can sustain these negative impacts for afflicted animals well after the noise itself has ceased.

The Channel Islands NMS Sanctuary Advisory Council identifies the threat from human-generated noise pollution as potentially having “major impacts” to cetaceans and fishes and warranting “precautionary management.”

> In sum, science to date supports the conclusion that anthropogenic noise represents a potential threat of sufficient magnitude to Sanctuary resources to warrant precautionary management. While understanding of the biological and ecological importance of noise and sound remains incomplete, significant data exists to strongly implicate anthropogenic noise in major impacts to individuals and populations of cetaceans and fishes.

(Polefka 2004 at 4).

Similar to other sources of marine acoustic pollution, shipping noise can have serious impacts on cetacean species. In one instance, a Cuvier's beaked whale (*Ziphius cavirostris*) was observed to have a reduced ability to use echolocation to find food in a foraging dive disrupted by a noisy vessel (Aguilar Soto *et al*. 2006). The NMFS recovery plan for Southern resident killer whales (*Orcinus orca*) describes the disturbance from vessel traffic and the associated noise pollution as a potential threat to the species in Washington State and British Columbia, where population numbers have fallen to below 100 individuals (NMFS 2008a). The recovery plan identifies "sound and disturbance from vessel traffic" as factors that currently pose a risk for this population of Southern resident killer whales (NMFS 2008a at II-71).

> Killer whales rely on their highly developed acoustic sensory system for navigating, locating prey, and communicating with other individuals. Increased levels of anthropogenic sound have the potential to mask echolocation and other signals used by the species, as well as to temporarily or permanently damage hearing sensitivity. Exposure to sound may therefore be detrimental to survival by impairing foraging and other behavior . . . (NMFS 2008a at II-103-104).

Species such as blue and fin whales (*Balaenoptera musculus* and *Balaenoptera physalus)* that communicate over vast distances in the ocean will increasingly have trouble hearing one another as the ambient noise level continues to rise. The masking of reproductive calls may prevent widely distributed mates from finding each other and reproduction rates may fall as a consequence (Weilgart 2007). This could have a significant impact on the survival of species such as Southern resident killer whales and blue whales, already listed as endangered species.[7]

Hearing loss, classified as either "temporary threshold shift" or "permanent threshold shift," is also a concern for animals exposed to the intense noise pollution produced by human activities. Hearing loss reduces the range in which communication can occur, interferes with foraging efforts and increases vulnerability to predators. Hearing loss may also change behaviors with respect to migration and mating and it may cause animals to strand, which is often fatal. For marine mammals such as whales and dolphins that rely heavily on their acoustic senses, both permanent and temporary hearing loss should be regarded as a serious threat (Hildebrand 2005).

Though difficult to detect, noise-induced stress is a serious threat for cetaceans (Weilgart 2007). In a noise exposure study using a captive beluga whale, increased levels of stress hormones were documented (Romano *et al*. 2004). Stress due to noise can lead to long-term health problems in terrestrial animals, and may pose increased health risks for populations by

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[7] With a population count of only 87 in 2007, every threat to the Southern resident killer whales must be viewed as a threat to the very survival of the species.

weakening the immune system and potentially affecting fertility, growth rates and mortality (Weilgart 2007).

It is not just cetacean species that are affected by noise pollution. Cephalopods exposed to low level, low frequency sounds have been shown to suffer permanent, massive acoustic trauma and death, raising serious question about noise pollution impacts throughout the food web (Andre *et al.* 2011). Fish, including commercial important stocks, are impacted as well. In the Mediterranean Sea, bluefin tuna (*Thunnus thynnus*) were confined to traps and exposed to local noise pollution from ship traffic to investigate possible noise-induced behavioral changes. The study showed that tuna exhibited deviations in schooling patterns, which could reduce the accuracy of their migration (Sara *et al*. 2007). Aggressive behavior was also more prominent in the tuna exposed to certain types of boat noise. In a freshwater study, fathead minnows (*Pimephales promelas*) exposed to white noise and boat engine noise showed persistent long-term hearing impairment (Scholik and Yan 2001).

The national marine sanctuaries located off the California coast were all designated as protected marine sanctuaries in part because of the rich biodiversity and important habitats they support. The threat of ocean noise pollution was not considered at the time of designation, and currently no regulations exist to directly control noise pollution from ship traffic.

C. Greenhouse Gas Emissions and Air Quality Impacts

Climate change and ocean acidification are having significant impacts on sanctuary resources, and these impacts will only worsen if greenhouse gas emissions continue unabated. Ships are significant contributors of greenhouse gas emissions and warming pollutants like black carbon, which exacerbate climate change, ocean acidification, and air pollution. Lowering marine shipping vessel speed would provide significant protections to sanctuary resources by reducing greenhouse gas emissions from ships, in addition to lowering fuel costs.

1. Climate Change

There is no longer any serious dispute that global climate change is happening and causing harm. The Intergovernmental Panel on Climate Change ("IPCC") expressed in the strongest language possible its finding that global warming is occurring: "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC 2007, Working Group 1 Report, Summary for Policymakers at 5).

Evidence of dramatic changes in Earth's climate abounds. The average temperature in the Northern Hemisphere over the last half-century is likely higher than at any time in the previous 1,300 years, while ice-core records indicate that the polar regions have not experienced an extended period of temperatures significantly warmer than today's in about 125,000 years (*id.* at 9). Further, the IPCC reports "[a]t continental, regional and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones" (*id.* at 7).

The IPCC concluded that greenhouse gas emissions produced from human activities have increased dramatically since the pre-industrial era and are the primary driver of observed climate change: "Global atmospheric concentrations of CO_2, CH_4 and N_2O have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years" *(id.* at 2). Further, "[m]ost of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations" (*id.* at 10). Thus, the world's leading scientific body on the subject has now concluded, with greater than 90 percent certainty, that emissions of greenhouse gases like carbon dioxide are responsible for climate change.

a) Carbon Dioxide's Contribution to Global Climate Change

Carbon dioxide's behavior in the atmosphere is well understood. Carbon dioxide is a "radiative forcing" gas, meaning that it alters the balance of incoming and outgoing energy in Earth's atmosphere (Solomon *et al*. 2007 at 21, n.1). Carbon dioxide absorbs terrestrial radiation leaving the Earth's surface, trapping this heat in the atmosphere (US EPA 2007 at 1-2). As levels of carbon dioxide increase, primarily from the burning of fossil fuels, less and less heat escapes the atmosphere to space, and the planet warms (*id.*).

As the U.S. Supreme Court has recently recognized, there is a consensus in the scientific community that the increasing atmospheric concentration of carbon dioxide is a leading cause of global climate change:

> A well-documented rise in global temperatures has coincided with a significant increase in the concentration of carbon dioxide in the atmosphere. Respected scientists believe the two trends are related. For when carbon dioxide is released into the atmosphere, it acts like the ceiling of a greenhouse, trapping solar energy and retarding the escape of reflected heat. It is therefore a species-the most important species-of a "greenhouse gas." *Massachusetts v. EPA*, 549 U.S. 497, 127 S. Ct. 1438, 1446 (2007).

It is abundantly clear that anthropogenic emissions of carbon dioxide are a principal driver of the observed warming of the planet. Prior to the industrial revolution, the global atmospheric concentration of carbon dioxide ranged from 180 to 300 parts per million ("ppm") over the last 650,000 years, but in 2005, global carbon dioxide levels reached 379 ppm (IPCC 2007, Working Group 1, Summary for Policymakers at 2). The increasing concentrations of this radiative forcing gas has led the IPCC to conclude that, "[c]arbon dioxide is the most important anthropogenic greenhouse gas" (*id.).* The IPCC found that increases in atmospheric carbon dioxide concentrations since pre-industrial times exert a radiative forcing effect of approximately +1.66 watts per square meter (W/m^2), "a contribution which dominates all other radiative forcing agents" (Solomon *et al.* 2007 at 25). In comparison, all other long-lived greenhouse gases combined contribute slightly less than approximately +1 W/m^2 (*id.* at 31).

b) Carbon Dioxide Emissions from Marine Engines and Vessels

Ocean-going ships are responsible for moving 80 percent of all goods shipped into and out of the United States (ITCC 2007 at 7). The sheer number of these ships, coupled with operating practices that use fuel inefficiently and poor government oversight, resulted in carbon dioxide emissions of 1046 million metric tons per year in 2007 (1153 million short tons per year, IMO 2009). Carbon dioxide emissions from shipping worldwide are estimated to make up almost three percent of global greenhouse gas emissions (IMO 2009). In fact, a single container ship emits more pollution than 2,000 diesel trucks (Poltrack 2000).

Of even greater concern is the projected growth in carbon dioxide emissions from shipping. Over the last three decades, the shipping industry has grown by an average of five percent per year (ICCT 2007 at 7). By 2050, one study predicts total carbon dioxide emissions from ships will grow to about 1700 million metric tons per year (1874 million short tons per year), roughly double their present levels (*id.* at 36, figure 13). However, this study "makes some judicious simplifying assumptions that tend to underestimate rather than overestimate fuel consumption and emission levels" (*id.* at 36). Thus, the IMO may present a more realistic picture of future carbon dioxide emissions from shipping in projecting a 72 percent increase between 2000 and 2020, assuming a three percent annual rate of growth (IMO 2000 at 17, Table 1-5). Even the IMO study may be too conservative. If fuel consumption increases at the rate forecast by current studies, shipping emissions may double 2002 levels by 2020 and triple them by 2030 (FOEI 2007a). Based on a recent IMO report, mid-range emission scenarios indicate that carbon dioxide levels from shipping, in the absence of controls, could increase by 150 to 250 percent by 2050 (compared to 2007 emission levels) (IMO 2009).

Even when only U.S. emissions are considered, ships account for a significant portion of total carbon dioxide. For example, based on national fuel consumption statistics, ships in the United States emitted nearly 100 million metric tons (110 million short tons) of carbon dioxide in 2005 (based on ship consumption of residual fuel oil, distillate fuel oil, and gasoline, *see* US EPA 2007 at 3-8 – 3-9, Table 3.7). In all, marine engines contributed about five percent of the total U.S. carbon dioxide emissions from transportation-related fossil fuel combustion (*id.*).

c) Nitrogen Oxides and Nitrous Oxide Contribute to Global Climate Change

Nitrogen oxides consist of a family of several compounds containing nitrogen and oxygen in varying amounts (US EPA 1999 at 1-2). Nitrogen oxides play a role in climate change through two primary means: (1) nitrogen oxides react with other substances to form the greenhouse gas ozone, and (2) nitrous oxide is itself a highly potent and long-lived greenhouse gas. Moreover, nitrogen oxide pollution represents an additional burden on oceanic pH levels by lowering pH and increasing acidity.

Emissions of nitrogen oxides contribute to global climate change by influencing the atmospheric concentration of ozone, which the IPCC has determined is the third most damaging greenhouse gas, after carbon dioxide and methane (Denman *et al*. 2007 at 544). As nitrogen oxides react with volatile organic compounds, they create ozone in the lower layer of the atmosphere, called the troposphere (US EPA 1999). Through the production of tropospheric ozone, nitrogen oxide emissions contribute to the warming of the surface-troposphere system (Denman *et al*. 2007 at 544).

Nitrogen oxides have also been found to contribute to ocean acidification, thereby amplifying one of the many deleterious impacts of climate change (Doney *et al*. 2007 at 14580). Approximately one third of all nitrogen oxide emissions end up in the oceans (*id.)*. The impact of these emissions on acidification is intensely felt in specific, vulnerable areas. In some areas it can be as high as 10 to 50 percent of the impact of carbon dioxide (*id.*). The hardest hit areas are likely to be those directly around the release site, so these emissions are especially significant in and around coastal waters (*id.*).

Nitrous oxide behaves very similarly to carbon dioxide in that it both directly traps heat in the atmosphere and remains in existence for many decades once emitted (IPCC 2007, Working Group 1 Report, Technical Summary at 27, 23-24). However, nitrous oxide is far more potent, with a global warming potential 298 times that of carbon dioxide over 100 years (*id.* at 33, Table TS.2). According to the IPCC, the concentration of nitrous oxide in the atmosphere in 2005 was 319 parts per billion (ppb), approximately 18 percent higher than its pre-industrial level (*id.* at 27). Moreover, data from ice cores indicate that in the 11,500 years before the Industrial Revolution, the level of nitrous oxide in the atmosphere varied by less than about ten ppb (*id.*).

d) Nitrogen Oxide Emissions from Marine Engines and Vessels

Ships are beyond doubt a significant source of nitrogen oxide emissions. Ships contribute as much as 30 percent of the world's nitrogen oxide emissions, an estimated 27.8 million tons per year (FOEI 2007b). In the United States, the EPA has already determined that marine engines and other nonroad engines and vehicles are a "major source" of nitrogen oxides. 59 FR 31,306, 31,307 (June 17, 1994). Recent EPA estimates show nitrogen oxide emissions from ships make up 9.1 percent of all U.S. mobile source nitrogen oxide emissions and 5.2 percent of U.S. nitrogen oxide emissions from all sources. 72 Fed. Reg. 15938 at 15963, Table II-3 (Apr. 3, 2007) (figures include NOx emissions from all categories of marine engines). Moreover, based on national fuel consumption statistics, EPA estimates that ships in the United States emitted approximately 2000 metric tons (2205 short tons) of nitrous oxide in 2005 (US EPA 2007 at 3-31, Table 3-24).

The contribution of ships to nitrogen oxide emissions is also projected to grow substantially in the coming decades. One EPA study forecasts that nitrogen oxide emissions from ocean-going ships in United States waters will increase by almost 300 percent above 1996 levels by 2030 (US EPA 2003 at 4-14, Table 4.3-1). Moreover, EPA's own modeling indicates that nitrogen oxide emissions from marine engines will grow to over 30 percent of all U.S. mobile source nitrogen oxide emissions by 2030 and will then account for 12.8 percent of total U.S. emissions of nitrogen oxides. 72 FR 15,938 at15,963, Table II-3 (Apr. 3, 2007) (figures include NOx emissions from all categories of marine engines). At the international level, emissions of nitrogen oxides from ships are projected to nearly double by 2050 and to increase their share of total nitrogen oxide emissions relative to other sources as well (ICCT 2007 at 35, figures 11 & 12).

These gases have a significant impact on the global climate, both through the formation of ozone and as nitrous oxide. Thus, given the large quantity of nitrogen oxides that ships emit, it is not surprising that marine engines' emissions of these pollutants play a significant role in climate change. In fact, nitrogen oxide emissions from ships are believed to have a net warming effect potentially equivalent to the warming effect from ship carbon dioxide emissions (*id.* at 34).

e) Black Carbon's Contribution to Global Climate Change

A product of inefficient combustion, black carbon, also known as soot, consists of microscopic solid particles of incompletely burned organic matter (*see* Chaimedes and Bergin 2002). As explained further below, black carbon is a potent warmer, exerting effects on the global climate both while suspended in the atmosphere and when deposited on snow and ice. In fact, one study estimates that a given mass of black carbon will warm the air between 360,000 and 840,000 times more than an equal mass of carbon dioxide (Jacobson 2002 at 10). The most pernicious characteristic of black carbon from a climatic perspective is its dark color and correspondingly low albedo, or reflectivity. Because of this dark coloring, black carbon absorbs heat from sunlight (Chameides and Bergin 2002 at 2214).

When suspended in the air, black carbon warms by trapping heat in the top of the atmosphere (Reddy and Boucher 2006 at 1). This direct warming leads to feedback effects which magnify the global warming contribution of black carbon (Jacobson 2002 at 6-8). For example, as black carbon particles absorb sunlight, they warm the air around them, decreasing the relative humidity of the air and thus the liquid water content of other particles suspended in the air (*id.* at 6). As these other particles dry, their own reflectivity is reduced, and as they absorb more sunlight the air warms even more (*id.*). Further, the water evaporated from such particles remains in the air as water vapor, which is itself a greenhouse gas (*id.* at 7).

When deposited out of the air onto a lighter surface, the darker black carbon causes the surface to absorb more of the sun's energy. Thus, when deposited on snow or ice, black carbon can reduce the snow's reflectivity and accelerate the melting process (Reddy and Boucher 2006 at 2). As when suspended in the atmosphere, black carbon's deposition onto ice and snow creates positive feedback effects that lead to even greater warming. For example, as snow and ice around them melt away, the deposited black carbon particles can become even more concentrated on and near the surface, further reducing the reflectivity of the remaining snow and ice (Flanner *et al.* 2007 at 2). Thus, although the IPCC estimates the radiative forcing effect of black carbon deposition on snow and ice to be $+0.1\ W/m^2$, it acknowledges that the radiative forcing metric may not accurately capture the climatic impacts of black carbon deposition on snow and ice. In the words of the IPCC, "the 'efficacy' may be higher" for black carbon radiative forcing, as it produces a temperature response 1.7 times greater than an equivalent radiative forcing due to carbon dioxide (IPCC 2007, Working Group 1 Report, Forster *et al.* 2007 at 184-85).

Because it can accelerate the melting of snow and ice, black carbon plays a particularly important role in Arctic climate change (Ramanathan and Carmichael 2008 at 224, Jacobson 2010 at 1). Moreover, the radiative forcing of suspended black carbon particles may be amplified at the poles, where there is more light reflected from the Earth's surface, and thus more light available for the black carbon particles to absorb (Forster *et al*. 2007 at 163). Because the Arctic has warmed at around twice the rate of the rest of the world over the last 100 years (IPCC 2009, Physical Science Basis, Trenberth *et al*. 2007 at 237), and may rise another four to seven degrees Celsius over the next century (ACIA 2004 at 10, 12), controlling and reducing black carbon emissions is particularly important for reducing Arctic sea ice loss and Arctic warming (Jacobson 2010 at 1).

The positive radiative forcing effect of black carbon has been estimated at 0.4 W/m^2 to 1.2 W/m^2 (Ramanathan and Carmichael 2008). The black carbon forcing of 0.9 W/m^2, with a range of 0.4 to 1.2 W/m^2, is larger than the forcings due to other greenhouse gases including CH_4, CFCs, N_2O, and tropospheric ozone, and may be as much as 55 percent of the forcing of CO_2 (Ramanathan and Carmichael 2008). Black carbon may be responsible for as much as 25 percent of observed global warming (ICCT 2007). Thus, the overall contribution of black carbon to global warming is thought to be substantial, perhaps second only to that of carbon dioxide (Chameides and Bergin 2002; Ramanathan and Carmichael 2008; Jacobson 2002).

f) Black Carbon Emissions from Marine Engines and Vessels

Marine engines account for a significant share of black carbon emissions. Black carbon is a component of the particulate matter emitted from ships and other engines. In fact, approximately 66 percent of anthropogenic black carbon emissions come from the burning of fossil fuels (Reddy and Boucher 2006 at 1). Marine shipping was responsible for 3.6 percent of the United States' black carbon emissions in 2002 (Battye and Boyer 2002 at Table 4). Globally, ships emit between 71,000 and 160,000 metric tons (78,264 and 176,370 short tons) of black carbon annually, or about 0.75 to 1.7 percent of total black carbon emissions (FOEI 2007b at 11; Lack *et al*. 2008 at 1). Moreover, shipping is responsible for all black carbon released over the oceans (Reddy and Boucher 2006 at 1).

Although black carbon from shipping is emitted mainly to the air above the oceans, plumes of black carbon can also travel great distances and deposit on areas far away from the initial emission site. For example, plumes of black carbon from Asia are believed to deposit on snow in the Arctic (McConnell *et al*. 2007 at 1383) and the Sierra Nevada (Hadley *et al.* 2010 at 7511). In the northern and central Sierra Nevada Mountains of California, large black carbon concentrations in the snowpack measured in 2006 were found to be sufficient to perturb both snow melt and surface temperatures; roughly one quarter to one third of the black carbon observed in the Sierra Nevada snowpack at high elevation sites is estimated to have been transported from Asia (Hadley *et al*. 2010 at 7511).

g) Global Climate Change Affects Sanctuary Resources

Climate change is already having profound effects on marine ecosystems, including decreased ocean productivity, altered food web dynamics, lower abundance of habitat-forming species, altered species distributions, and a higher incidence of disease (Hoegh-Guldberg and Bruno 2010 at 1523). According to a recent review by Hoegh-Guldberg and Bruno (2010), "[r]ecent studies indicate that rapidly rising greenhouse gas concentrations are driving ocean systems toward conditions not seen for millions of years, with an associated risk of fundamental and irreversible ecological transformation" (Hoegh-Guldberg and Bruno 2010 at 1523).

The California Current System, which runs along the west coast of North America and encompasses California's national marine sanctuaries, has experienced some of the most well-documented changes in ocean climate conditions in recent decades. This highly productive coastal upwelling ecosystem is sensitive to changes in the strength and timing of seasonal upwelling, affecting the entire food web. Upwelling occurs when offshore winds push surface waters away from shore, allowing cooler, nutrient-rich water to rise from depth into the sunlit, photosynthetic zone. This transfer of nutrients leads to rich plankton growth and accounts for much of the productivity of west coast waters. As coastal waters warm, however, upwelling events become weaker and ecosystem productivity decreases (Higgason and Brown 2008 at 2). In addition, warming temperatures may enhance the effects of the El Niño Southern Oscillation ("ENSO"), a naturally occurring climatic event. ENSO events off the California coast bring elevated ocean temperatures and sea level, increased onshore and northward flow, and decreased productivity. Reduced plankton abundance during these times is associated with diminished reproductive success and survivorship among some seabird and fish species, as well as marine mammals and other large predators that depend on krill and fish.

The California Current System has already experienced warming ocean temperatures, increased stratification, changes in upwelling, emerging hypoxic zones, and strong and frequent El Niño events. Surface temperatures have warmed in the California Current over the past century (Lynn *et al.* 1998, McGowan *et al.* 1998, Mendelssohn *et al.* 2003, Di Lorenzo and Miller 2005, Field *et al.* 2006). The temperature of the upper 100m of the southern California Current increased by 1.2-1.6 ºC between the 1950s and 1990s (Roemmich and McGowan 1995). This surface warming has been linked to the deepening of the thermocline (i.e. a deepening of warmer waters) and increased stratification in coastal regions of the California Current in the last 50 years (Palacios *et al.* 2004, Di Lorenzo and Miller 2005), which are associated with lower productivity since upwelling is more likely to bring warm, nutrient-poor waters to the surface (Behrenfeld *et al*. 2006). Delays in the onset of upwelling and the emergence of hypoxic conditions in the northern California Current in recent years have had negative consequences on productivity, including failures in breeding and recruitment, higher mortality, and population declines across trophic levels (Barth *et al.* 2007, Chan *et al.* 2008).

Species indicative of the health of northern California waters have exhibited declines in response to periodic changes in ocean conditions. One such species, the Cassin's auklet, primarily eats euphausiids (a type of zooplankton). Its reproductive success is closely tied to the strength and timing of upwelling events that sustain zooplankton in the areas surrounding its nesting colonies. Cassin's auklets abandoned breeding colonies during the strong ENSO events of 1983 and 1997, as well as the weakened upwelling periods in 2005 and 2006 (Higgason and Brown 2008 at 3). Such events have resulted in highly variable reproductive success over the past decade and concerns for the species' wellbeing (Sydeman *et al.* 2009). Similarly, abundance of juvenile rockfish, a key prey species for Chinook salmon, appears to be closely related to copepod abundance. Rockfish and salmon have exhibited poor productivity when zooplankton are scarce.

In addition to altering productivity, climate change will likely lead to changes in species assemblages in the sanctuaries off the California coast. Some species may shift their range northward in response to gradual temperature increases. Others may shift to deeper, cooler waters. Tide pools along the Monterey coast of California already demonstrate that species abundance and distribution is changing. Over six decades, shoreline ocean temperatures warmed by 0.79° C, cold-water species declined, and warm-water species increased (Sagarin *et al.* 1999). Similarly, in reef fish assemblages in the Southern California Bight, northern and endemic species declined and southern species increased following the shift to warm water conditions in the late 1970s (Holbrook *et al.* 1997). The composition of coastal and pelagic prey species, including euphausiid and larval fish assemblages, has also shifted (Brinton and Townsend 2003, Smith and Moser 2003). However, some species will likely be unable to move quickly enough to keep pace with changing ocean conditions. These species will likely face suboptimal living conditions, if not local extinction (ONMS 2009b at 21). Changing conditions, as well as gaps left by departed species, are expected to allow some warmer water species to move in. The effects of such changes in species' range and composition are difficult to predict. Nonetheless, the increased prevalence of a voracious warm water predator like the giant squid could have substantial repercussions on competing predators like marine mammals and sea birds (Higgason and Brown 2008 at 3).

Scientists predict that climate change will continue to have significant long-term effects on west coast marine ecosystems (Snyder *et al.* 2003, Harley *et al.* 2006). Warming ocean temperatures are expected to cause substantial changes in ocean circulation patterns, such as upwelling and currents (Harley *et al.* 2006). These changes, in turn, have major implications for ecosystem productivity and species composition. Sea level rise of as much as a meter is expected to occur within the next 100 years along the West Coast (Heberger *et al*. 2009), posing a particular threat to intertidal species and species dependent on estuarine ecosystems for nursery areas. The extent to which species will be able to adapt to warming waters, changes in circulation and prey availability, and altered water chemistry is unclear. However, these large-scale pressures, when added to existing pressures such as pollution, may well be too much for some species to survive.

2. Ocean Acidification

The oceans absorb about 22 million tons of carbon dioxide each day (Feely *et al.* 2006). The uptake of carbon dioxide can serve as a buffer against global warming, but it comes at a cost. The absorption of carbon dioxide into the ocean alters seawater chemistry causing waters to become more acidic. This process, ocean acidification, is advancing rapidly as humans release carbon dioxide into the atmosphere, and the changes in ocean chemistry are unlike anything experienced for millions of years.

The current atmospheric carbon dioxide concentration is at 393 parts per million ("ppm") and it continues to increase by 2 ppm annually (Mauna Loa Observatory: NOAA-ESRL, EPA 2009). This is a 38 percent increase from preindustrial levels, almost all of which is attributable to anthropogenic sources (*id.*). Three-quarters of carbon dioxide pollution comes from fossil fuel use, with most emitted from electricity generation followed by the transportation sector (*id.*).

About half of the carbon dioxide released into the atmosphere from human activities will be absorbed by the ocean.

Already ocean acidification has caused seawater pH to decrease by 0.11 units on average, which is equivalent to a 30 percent change in acidity (Caldeira & Wickett 2003; Orr *et al.* 2005; Caldeira *et al.* 2007; Feely *et al.* 2008). By the end of this century, carbon dioxide is predicted to reach 788 ppm and the pH of the ocean will to drop by another 0.3 or 0.4 units, amounting to a 100–150 percent change in acidity (Orr *et al.* 2005, Meehl *et al.* 2007). A pH change of this magnitude has not occurred for more than 20 million years (Feely *et al.* 2004). Scientific research indicates that carbon dioxide emissions will need to be stabilized below 350 ppm to avoid perilous biological consequences of ocean acidification (Hansen *et al.* 2008; *see also* McNeil & Matear 2008; Steinacher *et al.* 2009; Cao & Caldeira 2008).

A recent United Nations report indicates that changes from ocean acidification may have far-reaching implications for marine biodiversity and food security. Three billion people world-wide get 15 percent of their animal protein from fish and shellfish. Fisheries are the primary source of protein for one third (one billion) of these people. The report highlights studies that have shown direct negative impacts from ocean acidification on organisms such as oysters, and on important ecosystems such as corals. These changes have the potential to either directly (through changes to organisms) or indirectly (through changes in the food web) affect species that are harvested for subsistence and commercial operations in wild fisheries, shell fisheries, and aquaculture. The report concludes that marine stakeholders and policy makers need to be more aware of the environmental and food security issues associated with ocean acidification (UNEP 2010).

a. Ocean Acidification Is Occurring Along the U.S. West Coast

A combination of relatively low calcium carbonate levels and strong upwelling render marine waters along the U.S. west coast particularly vulnerable to acidification. First, the northeastern Pacific Ocean has a particularly shallow aragonite concentration horizon (defined as the depth at which seawater becomes undersaturated with respect to aragonite, $\Omega = 1$). Overall, the aragonite concentration horizon has decreased by as much as 40 to 200m as a direct consequence of the uptake of anthropogenic carbon dioxide (Feely *et al.* 2008). This indicates that the effects of ocean acidification are becoming more widespread throughout the water column.

This fact, combined with the strong seasonal upwelling, means that the Pacific Coast is extremely sensitive to the documented changes in the aragonite concentration horizon. A recent study along several transects off of the Oregon-California border showed that the entire water column became undersaturated with respect to aragonite during periods of upwelling (Feely *et al.* 2008). As a result, marine organisms in surface waters, in the water column, and on the sea floor along the Pacific Coast are already being exposed to corrosive water during the upwelling season. Similarly, a high resolution multi-year dataset collected off the coast of Washington state showed a rate of pH decline almost an order of magnitude higher than that previously predicted by models (Wootton *et al.* 2008). These studies underscore the urgency of the situation and demonstrate that rapid changes in seawater chemistry are already underway (Feely *et al.* 2008).

One of the major impacts of ocean acidification is that it impairs the ability of marine organisms to build protective shells and skeletons. The uptake of carbon dioxide by the ocean impairs calcification in animals because carbonate minerals, calcite and aragonite, become less available in seawater. Nearly all calcifying organisms studied, including species from the major marine calcifying groups, have shown an adverse response of reduced calcification in response to elevated carbon dioxide. According to the U.S. EPA:

> As more CO_2 dissolves in the ocean, it reduces ocean pH, which changes the chemistry of water. These changes present potential risks across a broad spectrum of marine ecosystems…For instance, ocean acidification related reductions in pH is forecast to reduce calcification rates in corals and may affect economically important shellfish species including oysters, scallops, mussels, clams, sea urchins, and lobsters…Impacts to shellfish and other calcifying organisms that represent the base of the food web may have implications for larger organisms that depend on shellfish and other calcifying organisms for prey.

(EPA 2009a: 17485)

Ocean acidification may adversely affect many marine organisms from plankton to corals. A brief review of the rapidly emerging science on ocean acidification suggests perilous biological consequences. Plankton, which form the basis of the marine food web, are among the calcifying organisms likely to be adversely affected by ocean acidification. Studies of the major classes of calcifying plankton showed that carbon dioxide related changes to seawater caused reduced calcification, resulting in malformed and incomplete shells (Riebesell 2000, Orr *et al.* 2005, Comeau *et al.* 2009, Kleypas *et al.* 2006). Modern shell weights of foraminifera in the Southern Ocean are 30 to 35 percent lower than those from preindustrial sediments, which is consistent with reduced calcification induced by ocean acidification (Moy *et al.* 2009). Ocean acidification's impact on calcifying plankton is especially troublesome because most of the ocean's primary production is from such plankton and effects will extend up the entire food chain.

Scientists predict that ocean acidification will also decrease calcification in shellfish significantly by the end of the century (Gazeau *et al.* 2007). For example, a recent study found that the calcification rates of the edible mussel and Pacific oyster decrease with increases in carbon dioxide (Gazeau *et al.* 2007). Experiments revealed that moderate increases in atmospheric carbon dioxide had significant effects on the survival and growth of sea urchins and snails (Shirayama 2005).

The effect of ocean acidification on Pacific coast ecosystems has also been the subject of recent studies. Changes in saturation state may cause substantial changes in overall calcification rates for many species of marine calcifiers, including those that are a major food source for local juvenile salmon (Feely *et al.* 2008). Additionally, many species of juvenile fish and shellfish of economic importance (including but not limited to mussels, clams, and oysters) are highly sensitive to increases in the concentration of carbon dioxide (Feely *et al.* 2008) and may be affected by even intermittent exposure to the corrosive waters noted throughout the water column in recent field measurements. Shell-forming marine life off the coast of Washington is adversely affected by even seasonal exposure to corrosive water. Such species exhibited increased probabilities of replacement by other species and decreasing probabilities of displacing other species as pH decreased (Wootton *et al.* 2008). Non-calcerous animals showed an opposite response, indicating a shift in the delicate ocean ecosystem (*id.*). California mussel beds are a dominant coastal habitat in the northeastern Pacific and provide an important food resource for humans. The California mussel is among the species adversely impacted by seasonal exposures to undersaturated water (*id.*). As mussel beds tend to be robust ecosystems, the sensitivity of these animals to decreasing saturation values may indicate much broader-scale impacts to less hardy ecosystems (*id.*).

Pacific coast oyster hatcheries are already experiencing difficulties associated with increasing ocean acidification. Two of the largest hatcheries report production rates down by as much as 80 percent (Miller *et al.* 2009). In July of 2008, upwelling of waters affected by acidification was the likely cause of a huge mortality event at the Whiskey Creek Shellfish Hatchery in Tillamook, Oregon (Barton *et al.* 2009). The die-off affected larvae of Pacific and Kumamoto oysters, Manila clams, and Mediterranean mussels, foreshadowing the widespread effects that increased upwelling events of corrosive waters will have on the fishing industry. Assuming business as usual projections for carbon emissions and a corresponding decline in ocean pH and mollusk harvests, the Pacific coast fishing industry could experience economic losses of up to $600 million by 2060 (Cooley *et al.* 2009).

Ocean acidification also disrupts metabolism and other biological functions in marine life. Changes in the ocean's carbon dioxide concentration result in accumulation of carbon dioxide in the tissues and fluids of fish and other marine animals, called hypercapnia, and increased acidity in the body fluids, called acidosis. These impacts can cause a variety of problems for marine animals including difficulty with acid-base regulation, calcification, growth, respiration, energy turnover, and mode of metabolism (Pörtner *et al.*2004). Squid, for example, show a very high sensitivity to pH because of their energy intensive manner of swimming (Pörtner *et al.* 2004; Rosa *et al.* 2008; Royal Society 2005). Because of their energy demand, even under a moderate 0.15 pH change, squid have reduced capacity to carry oxygen and higher carbon dioxide pressures are likely to be lethal (Pörtner *et al.* 2004). In fish, high concentrations of carbon dioxide in seawater can lead to cardiac failure (Ishimatsu *et al.* 2004). Some studies show that juvenile marine organisms are particularly susceptible to ocean acidification (Ishimatsu *et al.* 2004; Kurihara & Shirayama 2004).

Another serious consequence of ocean acidification is that it is intensifying ocean noise pollution for whales and other marine mammals (Hester *et al.* 2008, Brewer and Hester 2009). As the oceans become more acidic, changes in ocean chemistry allow low-frequency sound (~ 1–3 kHz and below) to travel much farther. Hester *et al.* (2008) found that the decrease in ocean pH from the pre-industrial era through the 1990s has already resulted in a significant reduction in ocean sound absorption. With the doubling of carbon dioxide in the atmosphere expected to occur in ocean surface waters by mid-century, sound at frequencies important for whales and other marine mammals will travel 70 percent farther, making ocean noise pollution an increasingly serious problem (Brewer and Hester 2009).

While the consequences of ocean acidification on marine life are complex, scientists predict that they will intensify ocean noise pollution and likely disrupt the marine food web with potentially detrimental consequences. Additionally, ocean acidification coupled with other environmental changes such as global warming can have cumulative and synergistic adverse impacts on ocean biodiversity (Guinotte and Fabry 2008). Carbon dioxide emissions must be reduced to avoid these consequences.

b. Ocean Acidification Has Documented Effects on Sanctuary Resources

While some uncertainty exists regarding the precise nature and extent of acidification impacts on NMS resources, existing evidence indicates that significant, long-term changes in NMS resources and communities are likely to take place in the coming years (Polefka and Forgie 2008 at 22; Higgason and Brown 2008 at 1-4; ONMS 2009b at 21-22).

A recent assessment of the likely effects of ocean acidification on Channel Islands NMS ecosystems shows that a number of key species are particularly vulnerable to ocean acidification, including kelp, coralline algae, pteropods, urchins, and abalone. Decreased pH appears to slow growth of reproductive filaments in bull kelp (*Nereocystis luetkeana*) and winged kelp (*Alaria marginata*), threatening an important habitat builder. Studies on purple urchin larvae have found that the larvae develop "short and stumpy" skeletons when subjected to sea water at pH expected to be reached by 2100, and are highly vulnerable to mortality from changes in ambient temperature (Polefka and Forgie 2008 at 24-25). Coralline algae, which is known to enhance the settlement and recruitment of abalones and other invertebrate grazers, experienced "severely inhibited" recruitment and growth under elevated CO_2 conditions (*id.* at 28). This poses an added threat to abalone species, which, like urchins, are thought to be particularly vulnerable to ocean acidification (*Id.*at 26). Finally, ocean acidification has been found to negatively affect at least some species of pteropods – planktonic swimming snails that feed much of the rest of the food web, including mollusks, fish, and whales (*id.* at 29-30). Pteropods produce aragonite shells. When seawater becomes undersaturated with respect to aragonite, they may be unable to produce or maintain their shells. While some may be able to shift their distribution to lower latitudes, scientists do not know whether they would survive the transition to warmer waters. Furthermore, declines in local pteropod abundance are linked with declines in their predators, including salmon (*id.*).

The Channel Islands NMS Advisory Council recognized the critical challenges posed by ocean acidification and recommended that Sanctuary staff "seize the opportunity to address ocean acidification through leadership among local ocean users, the public, and within the National Marine Sanctuary Program and NOAA." The Council went on to recommend that "staff should work collaboratively with its stakeholders to reduce CO2 emissions from all activities and uses associated with the Sanctuary" (*id.* at 36). All four California sanctuaries (Channel Islands, Monterey Bay, Gulf of the Farallones, and Cordell Banks) have passed resolutions recognizing ocean acidification as a significant threat to sanctuary resources and calling on the West Coast Regional Office to take a leadership role coordinating an approach among all the west coast sanctuaries.[8]

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[8] Cordell Bank National Marine Sanctuary Advisory Council. April 7, 2009. Resolution of the Cordell Bank National Marine Sanctuary Advisory Council Regarding Ocean Acidification and West Coast National Marine Sanctuary Sites; Gulf of the

3. Limiting Marine Shipping Vessel Speed Would Significantly Reduce Greenhouse Gas Emissions from Ships and Lower Fuel Costs.

Studies have shown that the most cost effective, feasible method to reduce emissions from ships is to slow the global fleet (FOEI 2007a at 6). Global greenhouse gas emissions are directly proportional to fuel consumption, and the amount of fuel ships consume is directly and exponentially related to vessel speed. Thus, slowing down results in significant savings in fuel (Maestad *et al*. 2000 at 39). Indeed, the IMO reports that a ten percent reduction in speed would result in a 23.3 percent decrease in emissions (IMO 2000 at 17, Table 1-5). At low speeds, ships are one order of magnitude more efficient than land transport and two orders more efficient than air transport (Isensee and Bertram 2004). However, as ship speeds increase, much of these efficiencies are lost. Very fast ships have been found to have energy demands similar to airplanes (*id*.).

Since the fuel consumption of a ship depends primarily on its speed rather than its size, the same amount of transport work can be achieved by more ships traveling at slower speeds, rather than fewer faster ships (Isensee and Bertram 2004 at 49). One case study compared the fuel consumption of two fleets, each providing the same transport capacity. The first fleet was made up of ten ships of 16-knot design speed, while the second was comprised of 14 ships of 10.5-knot design speed. The faster fleet consumed 140,000 tons of fuel in comparison to the slower fleet, which consumed 60,000 tons of fuel (a decrease of 57 percent in fuel consumption and therefore emissions) (*id.* at 49-50).

The Ports of Los Angeles and Long Beach already have a speed reduction scheme in place to reduce emissions, providing incentives for ships to remain at or below a speed of 12 knots. The ports have seen program participation rates over 90 percent, which have resulted in significant reductions in ship emissions (*see* Port of Long Beach 2008 at 5). In 2007, the ports estimate that the vessel speed reduction program resulted in the following reductions: 1,345 tons of nitrogen oxides, 832 tons of sulfur oxides, 112 tons of particulate matter, and 55,502 tons of carbon dioxide (*see* http://www.cleanairactionplan.org/strategies/vessels/vsr.asp). The California Air Resources Board estimated that the Port of Los Angeles would see reductions of 37 percent for nitrogen oxides and 49 percent for particulate matter in 2007 because of the initiative (CARB 2007). Similarly, the state's Air Resources Board is currently considering a vessel speed reduction initiative off the California coast (*see* http://www.arb.ca.gov/ports/marinevess/vsr/vsr.htm). These analyses illustrate another important point regarding regulations limiting vessel speed – they would have pollution reduction benefits extending to nitrogen oxides emissions as well. As discussed above, emissions of nitrogen oxides from ships also contributes to global climate change, and because restrictions on vessel speed would improve the fuel efficiency of ships, they would reduce the emissions of this pollutant per ton of cargo carried.

The shipping industry increasingly has recognized the economic value of reducing vessel speed (Rickmers 2010, Rosenthal 2010, Vidal 2010, White 2010). In order to lower costs and environmental impacts, some within the shipping industry have voluntarily implemented "super slow steaming" – the practice of operating a ship at a greatly reduced speed in order to burn less bunker fuel. In 2007, Maersk, a major international shipping company, initiated a comprehensive study of 110 vessels that proved, contrary to the traditional policy of running vessels with no less than a 40-60 percent engine load (a measure of how hard the engine is working), that its container ships can run safely with as little as a 10 percent engine load. In other words, Maersk found that its vessels could travel safely and efficiently at lower speeds. This makes it possible for vessels to travel at half-speed while realizing a 10 to 30 percent savings in fuel costs and carbon dioxide emissions. "Going at full throttle is economically and ecologically questionable," according to Maersk (Rosenthal 2010).

In the second half of 2009, numerous shipping lines, including APL, Zim Integrated Shipping Services, CMA CGM,"K" Line, Yang Ming, and South Korea's two largest box carriers, Hanjin Shipping Co. Ltd and Hyundai Merchant Marine Co., Ltd, followed suit (Rickmers 2010). The companies cited their desire to reduce their environmental footprint and achieve business sustainability as the reason for instituting the practice of slow steaming. Industry analysts say super slow steaming measures have been applied to almost 20 long-haul loops since November 2009, absorbing 2 percent of fleet capacity, and at current bunker fuel prices are producing a 5 to 7 percent savings on total operating costs on long haul loops (Brett 2010). These examples demonstrate that vessel speed reductions are both feasible and beneficial from an industry standpoint.

IV. THE NEED FOR MANDATORY MEASURES AND THE IMPORTANCE OF BUILDING UPON EXISTING VESSEL SPEED REDUCTION PROGRAMS.

Resource managers around the country have tried a number of strategies to alter vessel traffic behavior in order to reduce environmental impacts. Particularly instructive are the long-term efforts to reduce ship strikes on North Atlantic right whales off the East Coast and efforts to reduce ship speeds off southern California to improve air quality. The challenges and successes these programs have experienced provide valuable insights into how to build a successful regulatory program that protects multiple resources. Most importantly, they demonstrate that slowing ship traffic through the sanctuaries off the California coast will require building upon existing voluntary programs with a mandatory vessel speed limit.

NOAA, the Stellwagen Bank NMS, and a number of other agencies have carried out nearly a dozen research, monitoring, outreach, and regulatory programs over the past decade to reduce ship strikes on the critically endangered North Atlantic right whale. Many of the East Coast efforts have relied on issuing advisories to ships when a right whale was detected in the general vicinity. The advisories generally have asked that vessels either reduce vessel speed below 10 or 12 knots or re-route to avoid the area where right whales were detected (Abramson *et al.* 2011). As discussed in Section III above, NOAA has also established dynamic and seasonal management areas in areas where right whales are known to be present. Vessels may choose to re-route to avoid either type of area instead of reducing speed (*id.*).

While the recent programs implemented to protect North Atlantic right whales represent important steps forward, they also demonstrate the challenges associated with relying on voluntary measures to reduce vessel speed. Indeed, after years of relying on voluntary speed limits to slow ship traffic and protect right whales, NMFS concluded that voluntary limits were not effective because very few vessels actually comply with such discretionary measures:

> A study of mariner compliance with NMFS-issued speed advisories in the Great South Channel found that 95 percent (38 out of 40) of the ships tracked did not slow down or route around areas for which right whales sighting locations and speed advisories had been provided (Moller *et al*., 2005). Whether this is due to mariners disregarding the alerts or their being unaware of them is not known. In a related study, Wiley *et al*. (2008) found that commercial whale watching vessel operators exhibited high non-compliance rates even when they were aware of vessel speed zones around whales. Therefore, even when whale locations are detected and provided, it is not clear how, or if at all, mariners will respond.

NMFS 2008b at 1-11.

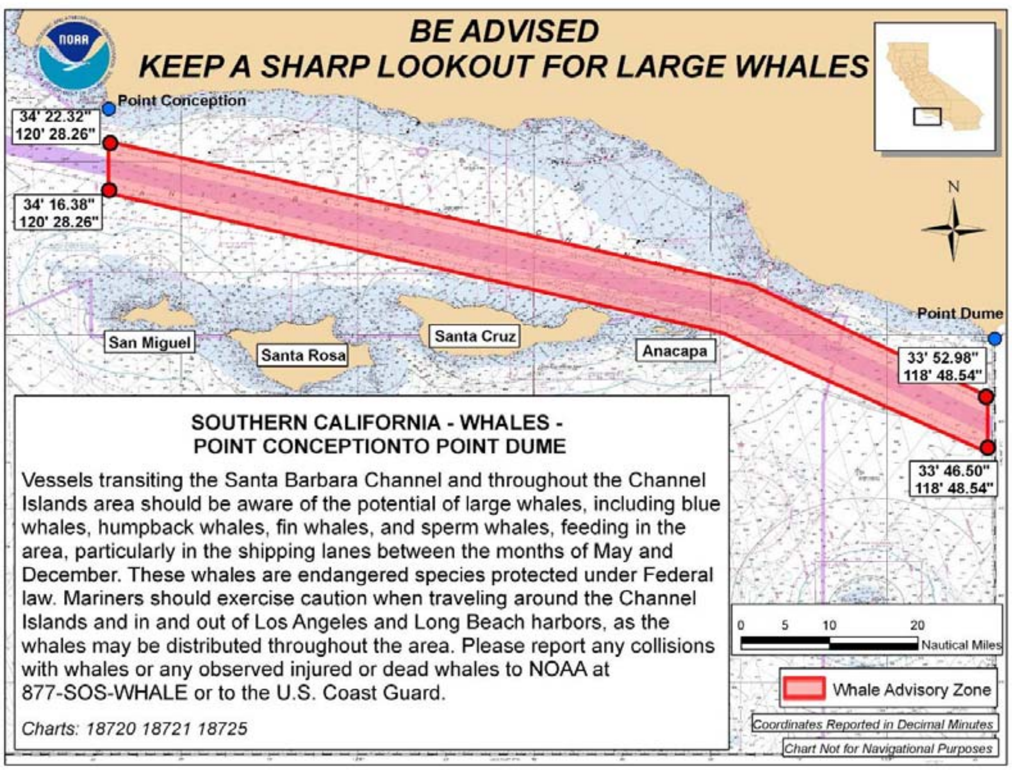
In December 2008, NMFS established a mandatory, seasonally based vessel-speed rule in addition to the previously recommended voluntary speed limits. A recent study (Lagueux *et al*., 2011) analyzed Automatic Identification System (AIS) data in order to compare compliance rates between the mandatory versus voluntary rules. The study found that:

> Vessel compliance was significantly higher under mandatory versus voluntary recommended speed restrictions, with compliance rates of 75 and 16%, respectively. Average vessel speeds were slower under mandatory speed restrictions (10.5 knots, 19.6 km h^{-1}) compared to voluntary recommended speed restrictions (14.5 knots, 26.9 km h^{-1}).

Lagueux, *et al*., 2011, at 69. This study thus confirms that mandatory speed limits are significantly more effective than voluntary ship speed limits.

Similarly, NMFS' advisories regarding the presence of blue whales in the Santa Barbara Channel and requests for voluntary ship speed reductions have gone almost entirely unheeded. In 2008, following the 2007 ship strikes, the TSS transiting the Santa Barbara Channel (between Point Conception to Point Dume) was designated a Whale Advisory Zone (see Figure 4 below). In addition, during 2008, 2009, and 2010 NMFS issued an Advisory Notice to Mariners highlighting the presence of endangered blue, humpback, fin, and sperm whales in the Santa Barbara Channel. This notice is broadcast seasonally when there are high densities of whales in the Channel, which typically occurs from May to December. The advisory notice specifically identifies high densities of these endangered whales feeding in the Whale Advisory Zone and recommends that ships voluntarily slow to 10 knots to reduce the chance of collision with whales in this zone. Using an Automated Information System (AIS), the staff at the Channel Islands NMS have been tracking shipping patterns and ship speeds in and around the Sanctuary. Analysis of the AIS data has provided an opportunity to determine if mariners are voluntarily complying with the notice. Data from 2008 and 2009 (October - November) indicates that during this time, cargo ships traveling through the Whale Advisory Zone were traveling an average speed of 18-19 knots; thus, clearly not heeding the requests for voluntary ship speed reductions. In 2010 (during the same time period) the average speeds of cargo ships through the Whale Advisory Zone was 14 knots.[9] While ships speeds in 2010 were slower than in previous years it does not appear that they slowed to the 10 knot voluntary speed limit. Furthermore, a representative from the Marine Exchange of Southern California suggested that the slower speeds in 2010 were possibly related to fog and the use of more expensive low sulfur fuels, not necessarily a result of the Notice to Mariners.[10] Thus, it seems that NMFS' advisories regarding the presence of blue whales in the Santa Barbara Channel and requests for voluntary ship speed reductions have gone unheeded. Clearly, voluntary speed limits in the Whale Advisory Zone near Channel Islands NMS are not an effective tool to reduce actual ship speed and protect whales.

Figure 7. Whale Advisory Zone for the Santa Barbara Channel. Source: Channel Islands Sanctuary Advisory Council meeting November 9, 2010. AIS data analysis was provided by Channel Islands NMS staff in a PowerPoint presentation at the November 19, 2010 Sanctuary Advisory Council meeting. The PowerPoint was provided to the general public upon request.



[9] AIS data analysis was provided by CINMS staff in a PowerPoint presentation at the November 19, 2010 CINMS Advisory Council meeting. PowerPoint was provided to the general public upon request.

[10] CINMS Advisory Council, Draft Key Meeting Outcomes, September 24, 2010. http://channelislands.noaa.gov/sac/pdf/key9-24-10.pdf. Accessed January 20, 2010.

Off the coast of Southern California, the Ports of Los Angeles and Long Beach ("Ports") have had greater success in reducing vessel speeds by combining voluntary speed limits with significant financial and operational incentives. The Ports have collaborated with the U.S. Environmental Protection Agency, California Air Resources Board ("CARB"), South Coast Air Quality Management District, and Marine Exchange of Southern California to implement a voluntary vessel speed reduction ("VSR") program, initiated in 2001, in order to lower emissions and improve air quality (Abramson *et al.* 2011). The Ports' two VSR programs aim to achieve compliance with a 12-knot speed limit with radial zones of 20 and 40nm from Point Fermin. The Port of Long Beach implemented incentives, including dockage discounts and favorable work gang assignments, for vessels that comply with a voluntary12-knot speed limit. These incentives have been critical in achieving more than 90 percent participation and compliance within 20 nm of the Port (*id.*). In contrast, the Port of Los Angeles has not offered dockage discounts for slower vessels, leading to substantially lower participation in its VSR program. While participating vessels were 100 percent compliant with the 12-knot speed limit in 2008, only about 20 percent of vessels bound for the Port of Los Angeles participated in that effort (*id.*).

The ONMS now has an outstanding opportunity to build upon the Ports' VSR programs, as well as ongoing efforts by the CARB to establish a 10-knot speed limit in waters within 24 to 40 nm of major California ports, to extend vessel speed reductions and thereby protect sanctuary resources, including whales, air quality, and water quality. The incentives the Ports have offered to vessel operators have been very effective in slowing ship traffic. As Abramson *et al.* (2011) note, extending the use of such incentives to reduce vessel speeds in the Santa Barbara Channel (or to sanctuaries) would require substantial coordination among agencies and, more significantly, substantial funding to carry out the program and potentially provide monetary incentives. Given the current state of the state and federal budgets, relying on an incentive-only structure seems infeasible. However, by implementing a mandatory speed limit in NMS waters, the ONMS would solidify and expand the progress the ports have made, as well as the gains CARB seeks to make. Such coordination among federal, state, and local agencies to achieve common marine resource management goals is precisely the aim of President Obama's developing National Ocean Policy (CEQ 2009a).

V. PROPOSED REGULATORY LANGUAGE ESTABLISHING 10-KNOT SPEED LIMIT IN NMS WATERS OFF CALIFORNIA COAST

We propose the following regulatory language to establish a mandatory 10-knot speed limit for large commercial vessels in the Channel Islands, Gulf of the Farallones, Cordell Bank, and Monterey Bay National Marine Sanctuaries.[11]

15 C.F.R. Ch. IX, Part 992

Subpart G – Channel Islands National Marine Sanctuary
922.72 Prohibited or otherwise regulated activities

(a)(14) Subject to specifications set forth below, vessels traveling through any portion of the Sanctuary may not exceed a maximum speed of 10 knots.

(A) The following restrictions apply to:
All vessels greater than or equal to 65 ft (19.8 m) in overall length and subject to the jurisdiction of the United States, and all other vessels greater than or equal to 65 ft (19.8 m) in overall length entering or departing a port or place subject to the jurisdiction of the United States. These restrictions do not apply to law enforcement vessels of a State, or political subdivision thereof, when engaged in law enforcement or search and rescue duties. A vessel conducting research may be exempt if the speed limit prevents the research from being carried out or interferes with the purpose of the research. Exempt vessels shall have an observer on board for the purpose of spotting whales and other marine mammals while the vessel is in transit.

(ii) Except as noted in paragraph (3) of this section, it is unlawful under this section:
(A) For any vessel subject to the jurisdiction of the United States to violate any speed restriction established in paragraph (15) of this section; or
(B) For any vessel entering or departing a port or place under the jurisdiction of the United States to violate any speed restriction established in paragraph (15) of this section.

(A) A vessel may operate at a speed necessary to maintain safe maneuvering speed instead of the required ten knots only if justified because the vessel is in an area where oceanographic, hydrographic and/or meteorological conditions severely restrict the maneuverability of the vessel and the need to operate at such speed is confirmed by the pilot on board or, when a vessel is not carrying a pilot, the master of the vessel. If a deviation from the ten-knot speed limit is necessary, the reasons for the deviation, the speed at which the vessel is operated, the latitude and longitude of the area, and the time and duration of such deviation shall be

[11] While we propose that these regulations be promulgated pursuant to NOAA's authority under the National Marine Sanctuaries Act, we recognize that NOAA also has authority to protect certain species that occur within NMS boundaries under the Endangered Species Act and Marine Mammal Protection Act. Should NOAA decide to promulgate regulations pursuant to these other authorities, we suggest that the same basic language be used.

entered into the logbook of the vessel. The master of the vessel shall attest to the accuracy of the logbook entry by signing and dating it.

Subpart H – Gulf of the Farallones National Marine Sanctuary
922.82 Prohibited or otherwise regulated activities

(a)(17) Subject to specifications set forth below, vessels traveling through any portion of the Sanctuary may not exceed a maximum speed of 10 knots.

(A) The following restrictions apply to:
All vessels greater than or equal to 65 ft (19.8 m) in overall length and subject to the jurisdiction of the United States, and all other vessels greater than or equal to 65 ft (19.8 m) in overall length entering or departing a port or place subject to the jurisdiction of the United States. These restrictions do not apply to law enforcement vessels of a State, or political subdivision thereof, when engaged in law enforcement or search and rescue duties. A vessel conducting research may be exempt if the speed limit prevents the research from being carried out or interferes with the purpose of the research. Exempt vessels shall have an observer on board for the purpose of spotting whales and other marine mammals while the vessel is in transit.

(ii) Except as noted in paragraph (iii) of this section, it is unlawful under this section:
(A) For any vessel subject to the jurisdiction of the United States to violate any speed restriction established in paragraph (17) of this section; or
(B) For any vessel entering or departing a port or place under the jurisdiction of the United States to violate any speed restriction established in paragraph (17) of this section.

(iii) A vessel may operate at a speed necessary to maintain safe maneuvering speed instead of the required ten knots only if justified because the vessel is in an area where oceanographic, hydrographic and/or meteorological conditions severely restrict the maneuverability of the vessel and the need to operate at such speed is confirmed by the pilot on board or, when a vessel is not carrying a pilot, the master of the vessel. If a deviation from the ten-knot speed limit is necessary, the reasons for the deviation, the speed at which the vessel is operated, the latitude and longitude of the area, and the time and duration of such deviation shall be entered into the logbook of the vessel. The master of the vessel shall attest to the accuracy of the logbook entry by signing and dating it.

Subpart K – Cordell Bank National Marine Sanctuary
922.112 Prohibited or otherwise regulated activities

(a)(8) Subject to specifications set forth below, vessels traveling through any portion of the Sanctuary may not exceed a maximum speed of 10 knots.

(A) The following restrictions apply to:

All vessels greater than or equal to 65 ft (19.8 m) in overall length and subject to the jurisdiction of the United States, and all other vessels greater than or equal to 65 ft (19.8 m) in overall length entering or departing a port or place subject to the jurisdiction of the United States. These restrictions do not apply to law enforcement vessels of a State, or political subdivision thereof, when engaged in law enforcement or search and rescue duties. A vessel conducting research may be exempt if the speed limit prevents the research from being carried out or interferes with the purpose of the research. Exempt vessels shall have an observer on board for the purpose of spotting whales and other marine mammals while the vessel is in transit.

(ii) Except as noted in paragraph (iii) of this section, it is unlawful under this section:

(A) For any vessel subject to the jurisdiction of the United States to violate any speed restriction established in paragraph (8) of this section; or

(B) For any vessel entering or departing a port or place under the jurisdiction of the United States to violate any speed restriction established in paragraph (8) of this section.

(iii) A vessel may operate at a speed necessary to maintain safe maneuvering speed instead of the required ten knots only if justified because the vessel is in an area where oceanographic, hydrographic and/or meteorological conditions severely restrict the maneuverability of the vessel and the need to operate at such speed is confirmed by the pilot on board or, when a vessel is not carrying a pilot, the master of the vessel. If a deviation from the ten-knot speed limit is necessary, the reasons for the deviation, the speed at which the vessel is operated, the latitude and longitude of the area, and the time and duration of such deviation shall be entered into the logbook of the vessel. The master of the vessel shall attest to the accuracy of the logbook entry by signing and dating it.

Subpart M – Monterey Bay National Marine Sanctuary

922.132 Prohibited or otherwise regulated activities

(a)(15) Subject to specifications set forth below, vessels traveling through any portion of the Sanctuary may not exceed a maximum speed of 10 knots.

(i) The following restrictions apply to:
All vessels greater than or equal to 65 ft (19.8 m) in overall length and subject to the jurisdiction of the United States, and all other vessels greater than or equal to 65 ft (19.8 m) in overall length entering or departing a port or place subject to the jurisdiction of the United States. These restrictions do not apply to law enforcement vessels of a State, or political subdivision thereof, when engaged in law enforcement or search and rescue duties. A vessel conducting research may be exempt if the speed limit prevents the research from being carried out or interferes with the purpose of the research. Exempt vessels shall have an observer on board for the purpose of spotting whales and other marine mammals while the vessel is in transit.

(ii) Except as noted in paragraph (iii) of this section, it is unlawful under this section:

(A) For any vessel subject to the jurisdiction of the United States to violate any speed restriction established in paragraph (15) of this section; or
(B) For any vessel entering or departing a port or place under the jurisdiction of the United States to violate any speed restriction established in paragraph (15) of this section.

(iii) A vessel may operate at a speed necessary to maintain safe maneuvering speed instead of the required ten knots only if justified because the vessel is in an area where oceanographic, hydrographic and/or meteorological conditions severely restrict the maneuverability of the vessel and the need to operate at such speed is confirmed by the pilot on board or, when a vessel is not carrying a pilot, the master of the vessel. If a deviation from the ten-knot speed limit is necessary, the reasons for the deviation, the speed at which the vessel is operated, the latitude and longitude of the area, and the time and duration of such deviation shall be entered into the logbook of the vessel. The master of the vessel shall attest to the accuracy of the logbook entry by signing and dating it.

Furthermore, we propose the following revisions to the Cordell Bank and Channel Islands Designation Documents, respectively:

Cordell Bank National Marine Sanctuary

Article IV. Scope of Regulation
Section 1. Activities Subject to Regulation

The following activities are subject to regulation, including prohibition, as may be necessary to ensure the management, protection, and preservation of the conservation, recreational, ecological, historical, cultural, archeological, scientific, educational, and aesthetic resources and qualities of this area:
. . .
i. Operating a vessel (i.e., water craft of any description) within the Sanctuary;

Channel Islands National Marine Sanctuary

Article IV. Scope of Regulations
Section 1. Activities Subject to Regulation

The following activities are subject to regulation, including prohibition, as may be necessary to ensure the management, protection, and preservation of the conservation, recreational, ecological, historical, cultural, archeological, scientific, educational, and esthetic resources and qualities of this area:
…
n. Operating a vessel (i.e., watercraft of any description) within the Sanctuary except fishing vessels or vessels traveling within a Vessel Traffic Separation Scheme or Port Access Route designated by the Coast Guard outside of 1 nmi from any Island unless regulations in those areas are necessary to conserve Sanctuary resources protected under the National Marine Sanctuaries Act, the Marine Mammal Protection Act, or the Endangered Species Act.

* * *

If any provision of this petition is found to be invalid or unenforceable, the invalidity or lack of legal obligation shall not affect other provisions of the petition. Thus, the provisions of this petition are severable. To the extent that NOAA finds the petitioned-for actions unwarranted, Petitioners alternatively request that NOAA promulgate regulations in the spirit of this petition that will create an enforceable and mandatory mechanism to protect endangered whales and marine mammals within California's sanctuaries from injury and death resulting from collisions with vessels.

CONCLUSION

NOAA has before it a unique, potentially precedent-setting opportunity to protect vast national marine sanctuary resources, surrounding ecosystems, and human health by implementing a simple measure to limit commercial vessel speed. While we do not wish to downplay the work that will be involved in implementing a mandatory speed limit for commercial vessels, it is important to recognize that this is a rare instance in which NOAA and its partners can address multiple environmental concerns and fulfill multiple federal objectives through a single mechanism. Implementing a mandatory 10-knot speed limit within the boundaries of the Gulf of the Farallones NMS, Cordell Bank NMS, Monterey NMS, and Channel Islands NMS will protect treasured sanctuary resources, including myriad whale species, as well regional water quality and air quality. Implementing this speed limit within NMS boundaries will also complement and strengthen the considerable efforts that local, regional, and State authorities have expended to improve regional air quality and lower the region's contribution to climate change and ocean acidification – which, in turn, threaten sanctuary resources. As this petition demonstrates, reducing the speed of commercial vessels traveling through our national marine sanctuaries will remedy a number of key environmental harms while enabling NOAA to meets its twin NMS management objectives of resource protection and sustainable human use. Petitioners respectfully request that NOAA seize this valuable opportunity and establish a mandatory 10-knot speed limit in the national marine sanctuaries off the coast of California.

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