



## **Reducing the Threat of Ship Strikes on Large Cetaceans in the Santa Barbara Channel Region and Channel Islands National Marine Sanctuary: Recommendations and Case Studies**

**U.S. Department of Commerce**  
National Oceanic and Atmospheric Administration  
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**Reducing the Threat of Ship Strikes on Large Cetaceans in the  
Santa Barbara Channel Region and Channel Islands National  
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Recommendations and Case Studies**

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## **COVER**

A container ship just missing a blue whale. Credit: NOAA.

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## **EXECUTIVE SUMMARY**

### **Problem Statement**

During September of 2007, NOAA received reports of five 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" (UME) on October 11, 2007, recognizing that the observed mortalities had met one or more criteria for the declaration of an 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, 2007. 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).

In response to these events, the Channel Islands National Marine Sanctuary (CINMS) and its Sanctuary Advisory Council (SAC) have been working to develop both short and long-term management measures to reduce the ship strike threat to Endangered Species Act (ESA) listed large whales in CINMS and the Santa Barbara Channel region. Information gathering through case studies and stakeholder engagement are the first steps towards a long-term plan.

### **Regional Context**

Ship strikes have been identified by the NMFS as a threat to endangered blue, right, humpback and fin whales (NMFS 1998, NMFS 2005, NMFS 1991, NMFS 2006). Most of the work analyzing the relationship between incidence of whale strikes and ship speeds has been done on the east coast in relation to the recovery of the highly endangered North Atlantic right whale. An analysis of ship and whale collisions showed that the chance of serious injury or death to the whale was reduced to 50% at speeds of 11.8 knots (Vanderlaan and Taggart 2007).

The Santa Barbara Channel contains some of the highest densities of commercial maritime traffic in the world. Many vessels transiting to or from the Ports of Long Beach and Los Angeles pass through the Channel (75% of the northbound departing vessel traffic and 65% of the arriving southbound traffic). On average, some 6,500 large (over 300 gross tons) vessels transit through the Channel every year, the majority of them at speeds greater than 14 knots (CINMS 2006).

The krill patches in the colder waters of the Channel Islands provide critical feeding grounds for the largest blue whale stock in the world (Fiedler et al. 1998). It has been speculated that krill aggregations in the Santa Barbara Channel and its shipping lanes

may lead to higher densities of several endangered baleen whale species, including humpback, blue and fin whales, making them vulnerable to ship strikes in this region. There have been a number of collisions involving large cetaceans on the west coast (Jensen and Silber 2004). Of the species known to have been hit by ships on the west coast, fin whales appear most affected, but blue, gray and humpback whales are also at risk (Douglas et al. 2008, Laist et al. 2001).

NMFS is the agency responsible for implementing the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) and protecting species throughout their range. The Channel Islands National Marine Sanctuary (CINMS) is responsible for implementing the National Marine Sanctuaries Act (NMSA) which includes protecting marine resources within the Sanctuary.

### **Public Process**

In order to focus specifically on the issue of ship strikes on ESA listed large whales, the CINMS SAC created a Ship Strike Subcommittee. Through case study synthesis and expert panel discussions, the Subcommittee generated a draft set of recommendations to reduce the threat of ship strikes on large whales in the Santa Barbara Channel region. These recommendations were reviewed and approved by the SAC and forwarded to the Sanctuary Superintendent in September 2009. The SAC process also included:

- *Prevention and Emergency Response Plan Development*  
This document exists in draft form and is currently utilized internally by CINMS, US Coast Guard, and NMFS staff. It outlines agency actions to track large whales in the Santa Barbara Channel region, implement precautionary actions to reduce the threat of ship strikes and respond quickly and appropriately to a stranded whale. The Emergency Response portion of this document is structured according to the Incident Command System used by the United States military (CINMS 2008).
- *Case Studies Development and Review*  
In regions such as Glacier Bay National Park (GLBA), Stellwagen Bank National Marine Sanctuary (SBNMS) and Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS), regulatory and cooperative actions have been implemented to reduce ship strikes on large whales. Analyses of successes, lessons learned, and applicability to CINMS and the Santa Barbara Channel region will inform the policy process.
- *Sanctuary Education Team*  
The Sanctuary Advisory Council's Sanctuary Education Team (SET) has initiated an outreach and education program for the general public and for the maritime industry.
- *Information Sharing Meetings*  
In the last year, meetings with NMFS, CINMS staff, commercial shipping agents and the California Ocean Protection Council have made progress in forming mutual goals. Representatives from the shipping industry have indicated an interest and willingness to work together.

In addition, Sanctuary staff continue to:

1. Host a ship strike web page (<http://www.channelislands.noaa.gov/focus/alert.html>);
2. Develop ecologically-based research and monitoring proposals (unfortunately, as yet unfunded) related to understanding and predicting ship strike conditions;
3. Work with partners at Scripps Institution of Oceanography on analysis of Automatic Identification System (AIS) ship data;
4. Support whale tagging work by Cascadia Research Collective's John Calambokidis, and help with deployment and servicing of Scripps' acoustic recording packages within and around the sanctuary;
5. Oversee the Channel Islands Naturalist Corps program which, among other things, trains and dispatches volunteers to collect whale identification data from commercial whale watch vessels; and
6. Conduct weekly aerial whale surveillance, compile whale observation data, generate map products, and communicate with the shipping industry and others.

Recent regulatory action by NMFS along the eastern seaboard to create Seasonal Management Areas (SMA), which are breeding and calving areas, and voluntary measures, including Dynamic Management Areas (DMA) and Areas To Be Avoided (ATBA), may have some transferability to the Santa Barbara Channel region and CINMS. Large whale species in the Santa Barbara Channel have somewhat predictable temporal behaviors (e.g., large concentrations are typically in the Channel from June through September). Additionally, Sanctuary Aerial Monitoring and Spatial Analysis Program data suggest that there may be spatial areas of greater whale aggregations.

NMFS has also provided the ship strike subcommittee a workshop report titled: *Report of a Workshop to Identify and Assess Technologies to Reduce Ship Strikes of Large Whales* (NMFS 2009) (see <http://www.nmfs.noaa.gov/pr/shipstrike/>). The workshop brought together leading experts to (a) identify existing or emerging technologies that might be useful in reducing ship strikes, (b) assess the feasibility of each in reducing ship strikes, and (c) identify research and development timelines needed to make a given technology useful in reducing the threat (NMFS 2009).

### **Case Studies**

The following case studies focus on the reduction of the threat of ship strikes on large whales. The first examines the role of the Stellwagen Bank National Marine Sanctuary and NMFS in protecting the North Atlantic right whale along the eastern seaboard of the United States. The second case study focuses on humpback whale protections implemented by Glacier Bay National Park and Preserve in Alaska. The third case study looks again at humpback whales, this time in their wintering grounds in the Hawaiian Islands National Marine Sanctuary. The final case study examines ongoing efforts by the Ports of Los Angeles and Long Beach (the entities comprising the San Pedro Bay Ports or (Ports)), in collaboration with the Marine Exchange of Southern California, the US Environmental Protection Agency (EPA), the California Air Resources Board (CARB), the South Coast Air Quality Management District (AQMD), and shipping industry

representatives to reduce air pollution through vessel speed reductions within the South Coast Air Basin, a multicounty area managed by the South Coast AQMD.

Each case study includes a summary of the range of research and monitoring projects, education and outreach initiatives and regulatory actions pursued to reduce the threat of ship strikes. The case studies each present an analysis of the relevance of these actions to CINMS and the Santa Barbara Channel region, with similarities and differences explicitly considered. Finally, recommendations for future opportunities are included in each study, along with key contacts and references.

### **Recommendations Adopted by the SAC<sup>1</sup>**

In general, the case studies presented indicate that dynamic (spatially and temporally explicit) management of vessel behavior can reduce the risk of ship strikes. They may also minimize impact on commercial activities by limiting vessel speed or course only during necessary times or in critical areas. Scientific data, such as, aerial monitoring, Automatic Identification System (AIS) data on commercial vessel movements, krill abundance and distribution data, whale tagging, and passive acoustic monitoring, is important when crafting effective dynamic management. All four case studies describe some form of a dynamic or spatial management area either to minimize whale-vessel interactions along the East Coast (Stellwagen Bank), Glacier Bay, Hawaii, or improve air quality in the case of the Ports of Los Angeles and Long Beach. It should be recognized that the creation of these management actions were time and resource intensive.

The case studies also demonstrate the effectiveness of mariner education and training. All case studies have required or used voluntary programs for recreational and/or commercial mariner training. In the case of Glacier Bay National Park and Preserve (see Case Study II), all cruise ships are required to participate in marine mammal awareness and avoidance training as conditional to permit issuance.

Specific recommendations include:

#### ***1. Continue and Expand Research and Monitoring Efforts.***

The key to any ship strike management measure, whether voluntary or regulatory, is a better understanding of the vessel strikes on large whales in the Santa Barbara region. The following research and monitoring efforts are recommended:

- a.** Continue and improve on monitoring efforts to track large whale distribution both spatially and temporally within the Sanctuary and shipping lanes, and in the vicinity of the shipping lanes (e.g., acoustic, aerial and photographic monitoring);
- b.** Improve understanding of the life history, biology, and behavior of large whales present in the Santa Barbara Channel region;

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<sup>1</sup> These recommendations were unanimously adopted by the Sanctuary Advisory Council (SAC) on September 18, 2009. For information on the Council's deliberations and vote, see <http://channelislands.noaa.gov/sac/minutes.html>.



- c. Monitor annual distribution of krill, which can be affected by oceanographic conditions and is critical to predicting large whale spatial distribution;
  - d. Continue and improve on monitoring efforts to track vessels (spatially and temporally) within the Sanctuary and in vicinity of the shipping lanes (e.g., AIS data, acoustic and aerial monitoring);
  - e. Recruit local colleges, universities, and research institutions to conduct research projects related to large whales and impacts of shipping traffic in the Santa Barbara Channel and greater southern California region;
  - f. Seek out additional sources of funding to continue monitoring and research efforts in the Santa Barbara Channel region;
- 2. *Consider appropriateness of changes to vessel behavior in the Santa Barbara Channel region.***
- a. In 2007, an unusually high number of blue whales were observed to be struck and killed by ship strikes in the Santa Barbara Channel. In response, NOAA now provides a speed reduction recommendation to mariners when whale abundance in the shipping lanes triggers an elevated concern of ship strikes. These speed reduction recommendations, if continued, need to be explicit and consistent so mariners can account for them during voyage planning;
  - b. In general, AIS data analysis has indicated that ships are not, in most cases, slowing to 10 knots in the Santa Barbara Channel despite the local notices to mariners and speed reduction recommendations. Consequently, the appropriateness of SMAs, DMAs, or ATBAs should be evaluated for the Santa Barbara Channel region. Use of these management tools, as described in the Stellwagen Bank National Marine Sanctuary Case Study, may provide shippers with the information necessary to decrease the risk of ship strike while transiting the Santa Barbara Channel;
- 3. *Explore Changes to the Santa Barbara Channel Traffic Separation Scheme.***
- Utilizing large whale distribution data from the Santa Barbara Channel, it should be explored if a shift in or narrowing of the traffic separation scheme (TSS) can separate commercial shipping traffic from concentrations of whales (e.g., a minor shift in the TSS off Boston Harbor). Any changes in the shipping lanes would need to consider impacts on other marine species in the area, as well as impacts on the shipping industry, recreational boaters, and other constituents that utilize the SBC;
- 4. *Continue and Expand Education and Outreach.***
- a. Expand education and outreach, including development of educational products, to other agencies, stakeholders, and the maritime industry in order to improve compliance with voluntary recommendations;
  - b. Assure education and outreach strategies and products are consistent with NOAA statutes (e.g., ESA, MMPA, and NMSA) and policies;

**5. *Explore Incentive and Mandate Based Options for Vessel Speed Reduction.***

In general, it has been determined that vessel speed reduction is an effective method to reduce the risk of harmful ship strikes on large whales. Therefore, both incentive based and mandate based approaches should be explored to reduce vessel speeds within the Santa Barbara Channel Traffic Separation Scheme. Incentive and mandate based options could be carried out simultaneously. Consideration of the application of relevant statutes (e.g., Marine Mammal Protection Act, Endangered Species Act, National Marine Sanctuaries Act, and others) will be necessary. It should be noted that a 10 knot speed limit is mandated by NMFS to protect North Atlantic right whales and has been recommended by NMFS when blue and humpback whales have been sighted in and near the shipping lanes between Point Conception and Point Dume during the summers of 2008 and 2009;

**6. *Apply an adaptive management approach for the implementation of the recommendations.***

Current and future science-based research and monitoring will help refine our understanding of whale distribution within the Santa Barbara Channel region, and this information should be integrated into the evaluation and consideration of any management option, including SMAs, DMAs, and ATBAs. A similar approach was used by NMFS on the eastern seaboard where data was collected, analyzed, and used in designating SMAs, DMAs, ATBAs, and other management options in order to protect Right Whales;

**7. *Continue to engage and involve relevant agencies, stakeholders and the maritime industry groups in the consideration and implementation of these recommendations.***

## **KEY WORDS**

Whales (blue, humpback, North Atlantic right), endangered, cetaceans, ship strike, Channel Islands National Marine Sanctuary, Santa Barbara, vessel speed reduction, Hawaiian Islands Humpback Whale National Marine Sanctuary, Glacier Bay National Park, Stellwagen Bank National Marine Sanctuary, National Marine Fisheries Service, recommendations, Sanctuary Advisory Council, case studies.

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## LIST OF ACRONYMS

AIS	Automatic Identification System
APCD	Air Pollution Control District
AQMD	Air Quality Management District
ATBA	Areas To Be Avoided
AZ	Advisory Zone
BRP	Bioacoustics Research Program
CAAP	Clean Air Action Plan
CARB	California Air Resources Board
CINMS	Channel Islands National Marine Sanctuary
CUA	Commercial Use Authorization
DMA	Dynamic Management Areas
DVQ	Daily vessel quota
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
GLBA	Glacier Bay National Park
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
IMO	International Maritime Organization
ITP	Incidental take permit
LNG	Liquefied Natural Gas
MARAD	Maritime Administration
MMPA	Marine Mammal Protection Act
MOU	Memorandum of Understanding
MPA	Marine protected area
NEPA	National Environmental Policy Act
NM	Nautical mile
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NOPP	National Oceanographic Partnership Program
NOS	National Ocean Service
NOx	Nitrogen oxides
NPCA	National Parks and Conservation Association
NPS	National Park Service
OGV	Ocean Going Vessel
ONMS	Office of National Marine Sanctuaries
PM	Particulate matter
POLA	Port of Los Angeles
POLB	Port of Long Beach
RIP	Relative Interaction Potential
SAC	Sanctuary Advisory Council

SAMSAP	Sanctuary Aerial Monitoring and Spatial Analysis Program
SBC	Santa Barbara Channel
SBNMS	Stellwagen Bank National Marine Sanctuary
SET	Sanctuary Education Team
SMA	Seasonal Management Areas
SO <sub>x</sub>	Sulfur oxides
SPLASH	Structures of Populations, Levels of Abundance and Status of Humpback Whales
SVQ	Seasonal vessel quota
TSS	Traffic Separation Scheme
UME	Unusual Mortality Event
USCG	United States Coast Guard
VSR	Vessel Speed Reduction

**CASE STUDY I: *Protecting Right Whales by Reducing the Risk of Mortality by Ship Strike in Stellwagen Bank National Marine Sanctuary and on the Eastern Seaboard, USA***



**Figure 1.** Photograph of breaching right whale. (Source: Trisha Cheney)

**Introduction**

The North Atlantic right whale (Figure 1) is one of the most endangered whales on the planet, with fewer than 400 individuals remaining. Human threats include ship strikes by large commercial vessels, strikes and behavioral modification from whale watching vessels, and fishing gear entanglement (Fujiwara et al. 2001, Kraus et al. 2005). In the early 1990s, mortalities due to ship strikes were considered a significant threat to the survival of the species, and NOAA began a sightings network to better understand the distribution of the animals along the eastern seaboard of the United States.

Management actions in the 1990s employed voluntary measures and outreach tools along with extensive research, however, ship strikes and mortalities continued each year. In 1999, it was determined that voluntary measures were insufficient to prevent the continued threat of ship strikes and improve the chances of recovery of the species. Between 1999 and 2001 the National Marine Fisheries Service (NMFS) hosted over 20 stakeholder meetings to discuss ways to reduce ship strikes and in 2001 formed a ship strike working group to address this urgent issue. A strategy for addressing ship strikes was developed with five major elements: ongoing research, education and outreach, Endangered Species Act (ESA) consultations on federal actions that may affect right whales, formal agreement with Canada to protect right whales, and operational measures for commercial and recreational vessels (Elizabeth Petras, NOAA NMFS, pers. comm.).

Within the Stellwagen Bank National Marine Sanctuary (SBNMS) there are three regulations that are applicable to commercial vessels. The first regulation shifts the Traffic Separation Scheme (TSS), which governs the movement of large commercial vessels. This has been negotiated with the United Nations' International Maritime Organization (IMO), the NMFS and the United States Coast Guard (USCG). This shift locates the majority of vessel traffic to a spatial area of historically low densities of right

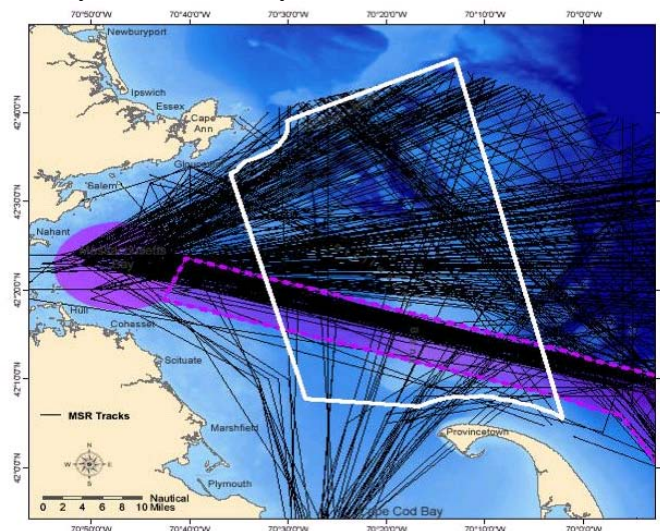


whales, and is predicted to reduce the probability of ship strike by 58% (SBNMS 2006a). The second regulation is a license condition implemented for Liquefied Natural Gas (LNG) carriers accessing two new ports in Massachusetts Bay which requires these vessels to slow to 10 nautical miles per hour (knots) or less in response to real-time acoustic detections of right whales in the TSS. The third regulation, administered by NOAA, establishes Seasonal Management Areas (SMAs) that require commercial ships to slow down to 10 knots or less within areas on the U.S. east coast, two of which overlap SBNMS boundaries during the right whale feeding season. Please refer to Appendix A for a timeline of the three above-mentioned management actions.

### Regional Context

As early as the 11<sup>th</sup> century, the North Atlantic right whale was subject to immense whaling pressure. The particular species was preferred by whalers due to their slow swimming pace and propensity to float when dead, which lead to their common name as the “right” whale to hunt. Recovery of the species has been slowed due to their unusually low reproductive rates and high vulnerability to the human threats mentioned above. In 1970 North Atlantic right whales were listed as endangered under the Endangered Species Conservation Act (the precursor to the Endangered Species Act (ESA)). In 1973 they were listed as endangered on the ESA and as depleted under the Marine Mammal Protection Act. Ship strikes were identified as one of the factors limiting recovery and survival of this species (NMFS 2005).

North Atlantic right whales calve in the warm coastal waters off Georgia and Florida during the winter. Some fraction of the population then travels north to the waters of the SBNMS and Cape Cod Bay in the early springtime to feed and nurse the calves. Some right whales are present in the SBNMS in the mid-late fall and throughout the winter months, too. In the summer, right whales can be found in Canadian Atlantic waters until early fall, when some fraction of the population migrates south (NMFS 2005). As noted above, NOAA has taken actions to protect North Atlantic right whales throughout their range, but this case study focuses mainly on activities within the SBNMS.



**Figure 2.** Reported paths of inbound ships (black lines) and the Traffic Separation Scheme (in purple) in relation to Stellwagen Bank National Marine Sanctuary (white boundary). (Source: SBNMS)

The SBNMS is located in Massachusetts Bay, between Cape Ann and Cape Cod, straddling the entrances to Boston Harbor, Provincetown and Gloucester (Figure 2). Its close proximity to these populous coastal zones gives it the designation of an “urban sanctuary” due to intense maritime commerce, fisheries, and tourist activity within its boundaries.

The Stellwagen Bank is an underwater plateau composed of sand and gravel which formed during the last ice age. The bathymetry of the bank creates ideal conditions for upwelling of cold, nutrient rich water, thereby supporting an abundance of marine life. Historically, this region has been host to some of the most productive fisheries in the world, including cod, bluefin tuna, lobster and herring. In addition, these waters serve as feeding and nursery grounds for several large whale species including the endangered humpback, northern right, sei, and fin whales.

### **Management Actions - Overview**

Eleven management actions have been taken to address the threat of ship strikes, fishing gear entanglement, and disturbance by whale watchers.

- 1) Research/Monitoring: Right Whale Sighting Advisory System (1997-2008)
- 2) Monitoring: Mandatory Ship Reporting Systems (1999-2008)
- 3) Research: Surveys of Human Use Patterns and Baleen Whale Sightings (2001)
- 4) Research: Voluntary Whale Watching Guidelines (2003)
- 5) Monitoring: Digital Tagging (2004-Ongoing)
- 6) Monitoring: Passive Acoustic Programs (2004-Ongoing)
- 7) Regulations: Recommended Shipping Routes (2006)
- 8) Outreach/Education: Mariner Training (2007-Ongoing)
- 9) Regulations: Shifting the Boston Traffic Separation Scheme (2007)
- 10) Regulations: Real-time Passive Acoustic Detections and Dynamic Speed Reduction by LNG Carriers (2007-Ongoing)
- 11) Regulations: Establishment of Seasonal and Dynamic Management Areas (2008)

A summary of each management action follows and a timeline associated with these actions is provided in the Appendix. The Key Contacts and References section provides links to additional information.

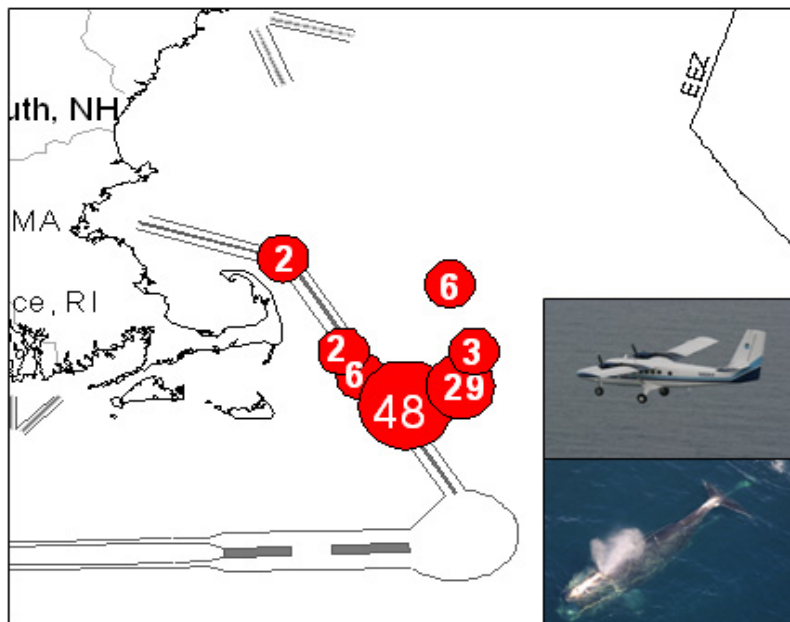
#### ***1) Right Whale Sighting Advisory System, 1997-2008***

In 1997, NOAA began conducting seasonal aerial surveys, using DeHavilland Twin Otter, Grumman Widgeon and Grumman Goose aircrafts. By 2004, over-flights were conducted year-round on a daily basis (weather permitting) and served three purposes. First, observers photographed individual right whales in order to contribute to a population database. Second, flights allowed surveys of areas farther offshore and the opportunity for systematic data gathering. Lastly, locations with right whale presence were designated “Advisory Zones” (AZs) and allowed for the creation of a “real-time” warning system for mariners (Figure 3). Ships were advised through

email, fax, NOAA Weather Radio or USCG broadcast Notice to Mariners to either route around the AZs or to reduce speed below 10 knots.

Advisories were distributed daily to ships. SBNMS and the USCG collaborated to analyze ship behavior within these AZs. The analysis included observational and Automatic Identification System data of 40 ships. Results showed one vessel re-route and two vessels reducing speed below 10 knots. The study was considered fairly inconclusive, however, as it was unclear whether ships were not receiving advisories or whether they were choosing not to respond (Moller et al. 2005).

The ship advisories have been terminated due to new legislation. Also, there is anecdotal information suggesting that the Advisory Zones were causing a lack of clarity in policy. In addition, in the busy ports along the eastern seaboard the AZ information may have been “washed out” with the huge volume of information flowing through several communication channels. Aerial flights now focus on the monitoring program and designation of Dynamic Management Areas for commercial vessels (Tim Cole, NMFS/NEFSC Protected Species Branch Research Fish Biologist, pers. comm.).



**Figure 3.** Right Whale Advisory Zones shown in red circles with the numbers of whales spotted from aerial surveys. (Source: SBNMS)

## 2) *Mandatory Ship Reporting Systems*, July 1, 1999-2008

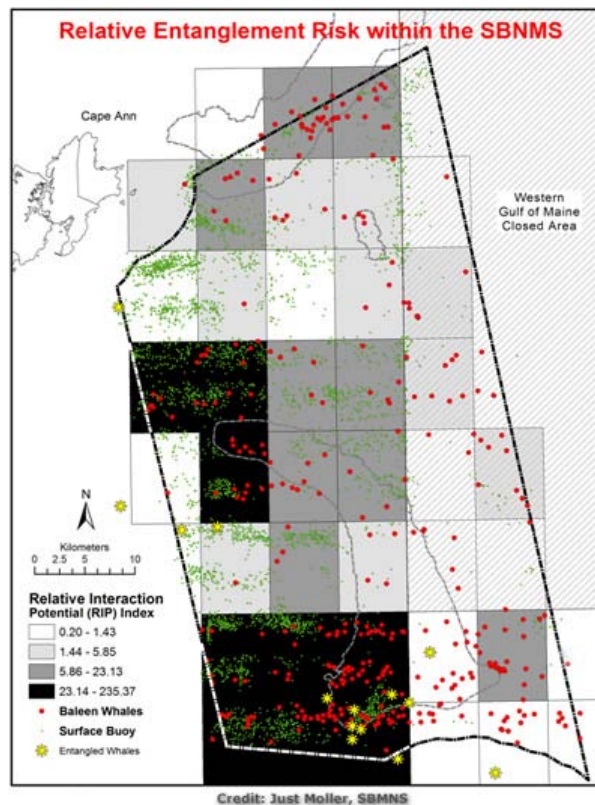
Through a coordinated effort between NOAA and the USCG (and adopted by the IMO), all vessels over 300 gross tons must report using INMARSAT C (a two-way satellite communications system used in the maritime industry) to a shore-based station when transiting two key right whale habitats (off Massachusetts and Florida/Georgia coast). Reporting vessels are sent a message containing recent sightings in the area, as well as information about right whales and measures that can be taken to avoid collisions (Figure 4) (US DOT 1999).

*You are entering essential habitat for North Atlantic right whales. The species is critically endangered and vulnerable to being hit by ships; whales may not avoid approaching ships. Collisions can damage sonar domes, propellers or shafts. Exercise prudent seamanship and advance planning to avoid right whales. Assume any whale sighted is a right whale. Monitor USCG Broadcast Notice to Mariners, NAVTEX, NOAA Weather Radio, Cape Cod Canal Vessel Traffic Control and Bay of Fundy Vessel Traffic Control for latest advisories and sightings. Consult NAVTEX, INMARSAT C SafetyNET, US Coast Pilots, and Notices to Mariners for ways to avoid hitting right whales and applicable regulations. Right whale critical habitats and Stellwagen Bank National Marine Sanctuary are marked on recently updated charts. Placards, videos and other material are available from shipping agents, port authorities, port pilots, and USCG. Please report all struck, dead or entangled whales immediately to USCG on VHF Channel 16. Be advised that whales may or may not remain at reported locations for extended periods. Surveys do not detect all whales and are not flown in poor weather. Whales, including other whale species, may occur at unreported locations. Whales were sighted at:  
 [xxx]N, [xxxx]W @ [xxx]h, [date]  
 [xxx]N, [xxxx]W @ [xxx]h, [date]*

**Figure 4.** Northeast Reporting Area (Sample Reply Message). (Source: US DOT)

### 3) *Surveys of Human Use Patterns and Baleen Whale Sightings, 2001*

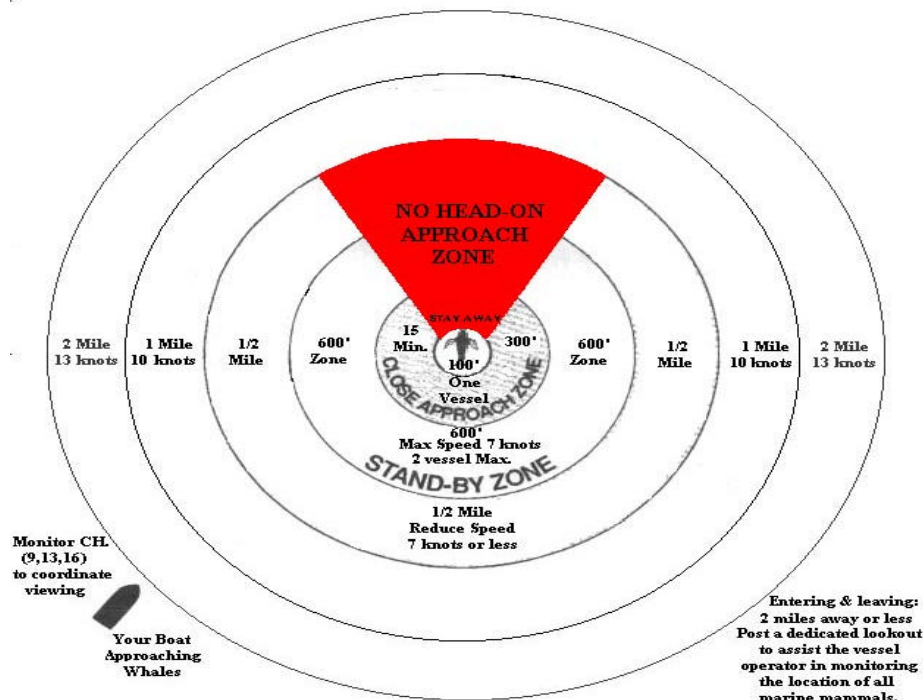
The SBNMS conducted a year-long survey aimed at identifying hotspots where mobile and fixed fishing gear-use co-occurs with larger densities of baleen whales. The distribution and abundance data for fishing practices and baleen whale presence was utilized to calculate a Relative Interaction Potential (RIP), with areas of high RIP indicating regions where whales might become entangled in fishing gear (Figure 5). This data is considered essential for small-scale management decisions within and beyond the Sanctuary (Wiley et al. 2003a).



**Figure 5.** Relative entanglement risk within the SBNMS. (Source: Just Moller, SBNMS)

#### 4) *Voluntary Whale Watching Guidelines, 2003*

SBNMS initiated a study to determine the degree of compliance to NMFS voluntary guidelines (Figure 6) by whale watching vessels. Inconspicuous observers with hand-held GPS units were placed on various whale watching vessels from August to October of 2003. The distance and bearing from whales was determined by military grade binoculars, which allowed calculation of the geographical location. GIS software was then used to evaluate compliance to voluntary guidelines. The results indicated that whale watching vessels frequently did not comply with these guidelines. In addition, the evidence suggested that non-compliance increases as the distance from the whale increases. Essentially, vessels were accelerating at moderate distances from whales and underestimating the safe distance for various speeds. Non-compliance rates were 63% in Zone 1 (within 300' radius of the whale), 92% in Zone 2 (within 600' radius) and 94% in Zone 3, (within 1/2 mile radius) (see below) (Wiley et al. 2003b).



**Figure 6.** Whale watch vessel guidelines. (Source: SBNMS)

#### 5) *Digital Tagging, 2004-Ongoing*

In 2004, SBNMS began a research program using digital recording tags attached to marine mammals to increase the understanding of whale behavior and activities. The tags have provided important information about whale distribution, geographic location and depth in the water column, which, in turn, has informed management decisions (SBNMS 2006b).

**6) *Passive Acoustic Programs*, 2004-Ongoing**

Passive acoustic monitoring is also used to study the underwater “noise” of Stellwagen Bank. This includes gauging the impacts of anthropogenic noise, such as shipping, sonar and other long-term, low-level noise, in the area. Current research is a collaboration between SBNMS, the NMFS Northeast Fisheries Science Center, Cornell Laboratory of Ornithology’s Bioacoustics Research Program (BRP) and Marine Acoustics, Inc. (a private marine technology company) and is funded by an award from the National Oceanographic Partnership Program (NOPP) (SBNMS 2008).

**7) *Recommended Shipping Routes*, November 2006**

Working with a long time series dataset of visual sighting records for baleen whales in the SBNMS, Sanctuary researchers identified recommended transit routes for commercial shippers that avoided whale aggregation areas. Right whale distribution was shown to be correlated with currents that drive copepod distribution and abundance in Massachusetts and Cape Cod Bays, and other large baleen whale distributions were shown to be related to bottom types preferred by small schooling fish upon which the whales prey (Leila Hatch, SBNMS, pers. comm.).

With collaboration from NMFS and the USCG, these routes were further fine-tuned to ensure safe navigation and minimizing impacts on the industry. This step was the first move toward officially shifting the Traffic Separation Scheme leading into Boston Harbor (see Management Action 9).

**8) *Mariner Training*, 2007-Ongoing**

Educational placards, posters and videos for mariners explain how they can avoid a collision with a whale. Recommended actions include:

- Maintain a vigilant watch.
- Maintain a distance of 100 yards or greater from marine mammals; 500 yards or greater for northern right whales.
- Reduce speed to 10 knots or less when one or more large cetaceans are observed.
- If animal is in vessel path or close proximity, reduce vessel speed and shift engine to neutral.

Also, SBNMS and the NMFS maintain two websites specifically focused on right whale protection, and the regular update of NOAA Navigational Charts includes recent Right Whale Advisory Zones (see Management Action 6 for more information on Advisory Zones) (NOAA 2009a, NOAA 2009b).

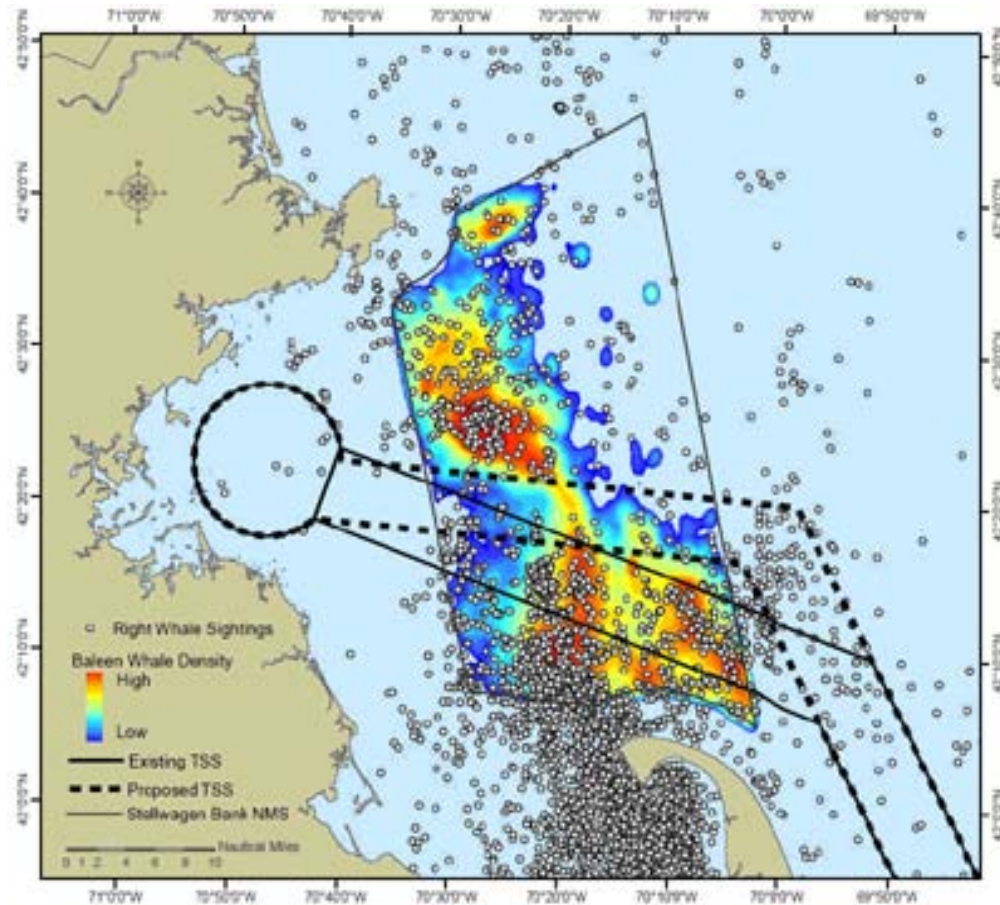
**9) *Shifting the Boston Traffic Separation Scheme (TSS)*, July 1, 2007**

Utilizing scientific data on whale density distribution near the TSS, SBNMS determined that rotating the scheme 12 degrees north and narrowing each lane by half of a nautical mile (NM) each would spatially locate the TSS in an area which would reduce the likelihood of ship strikes by 81% for all baleen whales and 58% for right whales in particular (SBNMS 2006a). The predicted increase in vessel transit time for a one-way trip is between 9 and 22 minutes.

Data used for implementation:

- Long-term distribution of baleen whale sightings.
- Habitat characterization.
- Whale feeding ecology.
- Characterization of large commercial vessel use of SBNMS.
- Requirements for proposal to IMO.

Policy process: The Office of National Marine Sanctuaries, NOAA NMFS Office of Protected Resources, and NOAA's General Counsel for International Law jointly proposed to the International Maritime Organization shifting the current TSS 12 degrees to the north. IMO adopted this measure (Figure 7). The process took roughly 7 years to accomplish due to multiple stakeholder groups involved and the data requirement for an IMO proposal.



**Figure 7.** Shift in the Traffic Separation Scheme to avoid high-density areas of baleen whales in the SBNMS and surrounding region. (Source: SBNMS)

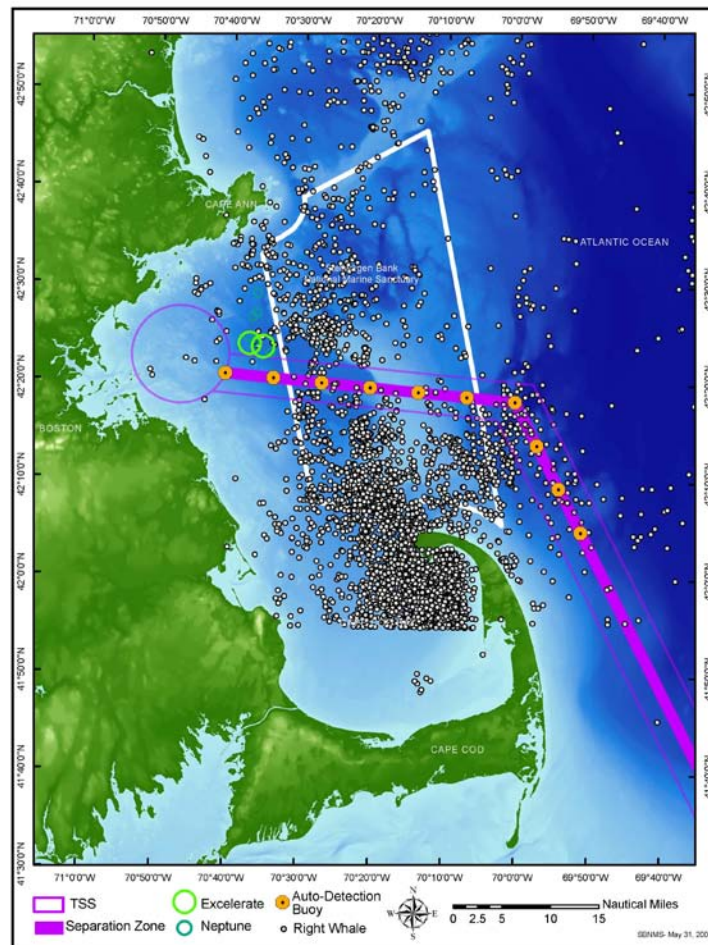
Automatic Identification System (AIS) data shows high compliance by vessels using the new TSS. Transiting within the TSS is not required of vessels by either the USCG or IMO, though failure to follow TSS often carries liability should a collision or other incident occur. Although vessel and whale monitoring indicated that the shift in the TSS would reduce the risk of vessel and right whale collisions by 58%, it is difficult to link this action, in isolation, to population-level recovery (SBNMS 2006a). SBNMS is working with NOAA Office of Protected Resources, NOAA NMFS Northeast Fisheries Science Center, the Right Whale Consortium, and other groups to monitor changes in right whale populations resulting from the shift in the TSS. Thus far, acoustic monitoring data have supported the hypothesis that large baleen whales are present more often in areas outside the newly-shifted TSS than they are inside the newly-shifted TSS (Leila Hatch, SBNMS, pers. comm.).

**10) *Real-time Passive Acoustic Detections and Dynamic Speed Reduction by Liquefied Natural Gas Carriers, 2007-Ongoing***

An array of auto-detection buoys (Figure 8) has allowed NOAA to better detect right whale presence by digital and expert (human) recognition of their signature upcall. This research shows that in some conditions, this system can be more successful in detecting the presence of right whales than visual observations from a ship or aerial



monitoring. Surface buoys are connected to hydrophones suspended in 60-120 feet of water, which listen for the right whale upcall. When one of these calls is detected by software designed to recognize the frequency, timing and several other characteristics of the upcall, the data is transmitted to the Cornell Lab of Ornithology, where analysts in the Bioacoustics Research Program confirm or decline the detection as a true upcall. Analysts issue updates to Liquefied Natural Gas (LNG) carriers transiting through or near the array (Cornell Lab of Ornithology 2009). The reports are also available through the Right Whale Sighting Advisory System, operated by NOAA. These reports are available online, are sent via email to relevant distribution lists and are included in marine safety bulletins, such as Notice to Mariners.



**Figure 8.** The array of real-time acoustic detection buoys and location of LNG terminals. Right whale sighting data for areas of interest was taken from the North Atlantic Right Whale Consortium Database. (Source: SBNMS)

In order to obtain licensing for the building of two LNG offshore ports adjacent to the SBNMS’s western boundary, the licensing agencies — USCG and Maritime Administration (MARAD) — require LNG carriers Neptune, LLC and Excelerate, LLC to reduce their speeds in zones where a detection buoy has indicated right whale presence within the last 24 hours, as well as comply with Seasonal Management Areas (SMA) speed zones (which had not been implemented at the time, but were

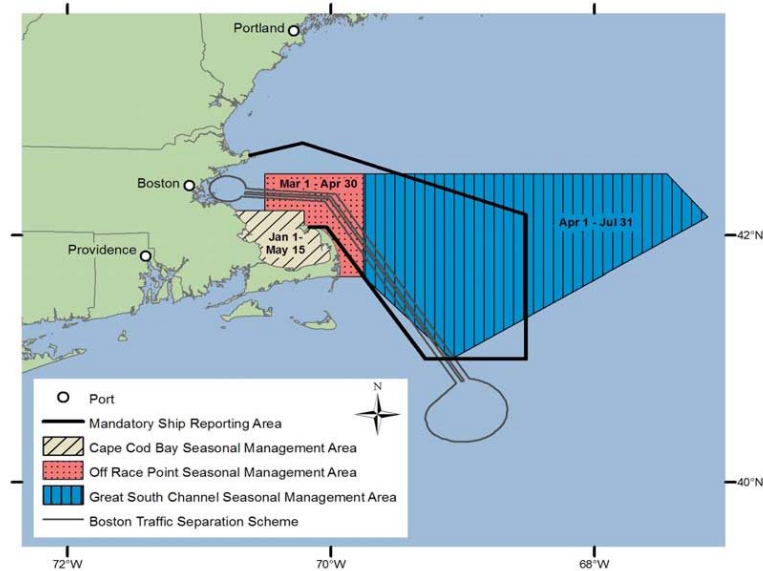
being considered—see below, Management Action 11). The carriers are required, as a condition of licensing, to maintain the buoy network for the life of their ports (25-40 years).

To date, Automatic Identification System (AIS) data shows 100% compliance by LNG carriers to these conditions, although the small number of gas shipments to the single operational port (two total) and short period of time since implementation (16 months) makes it difficult to assess whether the additional risk of ship strikes associated with port activities has been successfully eliminated or reduced by this mitigation system. Furthermore, constant monitoring of the auto-detection buoys is very costly. Since the building of both LNG ports, however, there have been no ship strikes by LNG carriers (Leila Hatch, SBNMS, pers. comm.). The buoy array is shown in Figure 8, with each buoy indicated by an orange dot. The spatial arrangement is related to the propagation of right whale upcalls in the acoustic environment of the Sanctuary and the shipping lanes.

**11) *Seasonal and Dynamic Management Areas and Area to be Avoided*, 2008-Ongoing**

This regulation is the culmination of roughly 12 years of work, and much of the preceding data and management actions directly contributed or led to the establishment of Seasonal and Dynamic Management Areas, or SMAs and DMAs, by NOAA (Figure 9). NMFS has mandated that vessels exceeding 65 feet must, during certain times of the year, reduce their speed below 10 knots to reduce the risk of collisions with right whales. Vessels may also re-route to avoid the SMAs or DMAs. Ships are exempt from this regulation in times of bad weather and/or poor visibility, in order to maintain safe maneuvering speeds. SMAs and DMAs exist along the entire eastern seaboard, and not solely in the SBNMS (Federal Register 2008). Figure 9 contains three SMAs – the Great South Channel, Cape Cod Bay, and Off Race Point Management Areas. All regions have different, seasonal intervals where speed reduction or avoidance is required. DMAs move with whale presence (approximately every two to six weeks) and remain voluntary speed reduction zones (Tim Cole, NMFS, pers. comm.).

SMA managers lower speeds in Cape Cod Bay from January 1 to May 15, Off Race Point from March 1 to April 30, and in the Great South Channel from April 1 to July 31. Both the Cape Cod Bay and the Off Race Point SMAs overlap with the SBNMS; with 8.17% of the sanctuary contained in the Cape Cod Bay SMA and 55.02% contained in the Off Race Point SMA. Accordingly, 36.81% of the SBNMS, primarily the northwestern and northeastern corners and the western boundary of the sanctuary, is not included in speed regulations at any time of year. From March 1 to April 30 (two months) when both Cape Cod Bay and Off Race Point SMAs are operational, 63.19% of the sanctuary is included in mandated speed reductions. Dynamic Management Areas (DMAs) can also be implemented outside of SMA time periods and areas to protect visually-sighted groups of right whales. At this time, speed reductions are mandatory within SMAs and voluntary within DMAs (Leila Hatch, SBNMS, pers. comm.).



**Figure 9.** The distribution of SMAs and DMAs in the SBNMS region. SMAs and DMAs exist throughout the eastern seaboard. (Source: SBNMS)

Since the implementation of SMAs and DMAs in January 2009, preliminary AIS monitoring by both the NMFS and SBNMS indicate that only about 50% of vessels have been complying with the speed reductions below 10 knots in SMAs. Further assessments of voluntary compliance with DMAs are ongoing. Compliance studies will continue to be important in the first years of implementation of the rule to assess the needs for further outreach and enforcement actions to improve the effectiveness of the regulation (Leila Hatch, SBNMS, pers. comm.).

Most recently in June 2009, the NMFS implemented the Great South Channel Area to be Avoided (ATBA) which establishes the feeding areas where risk of ship strikes is greatest. The NMFS requests that in the months from April through July, ships greater than 300 tons reroute to avoid travelling through the ATBA. It is predicted that implementation of the ATBA will reduce the relative risk of right whale ship strikes by 63% (NOAA 2009c). Compliance with this voluntary recommendation has yet to be determined.

### **Analysis: Potential Application to the Santa Barbara Channel Region**

This section analyzes the extent to which the management actions on the east coast might be applied in the Santa Barbara Channel region. There are multiple lessons to be learned from the management strategies of SBNMS. Management actions that may be transferable to Santa Barbara Channel region include education and outreach programs, improved monitoring efforts and Seasonal Management Areas.

#### *Similarities:*

- High densities of commercial shipping traffic (both SBNMS and CINMS are located near or in international shipping lanes).

- Biodiversity hotspots (both SBNMS and CINMS are located in areas with endangered species and valued ecosystems).
- Threat of ship strikes to endangered species (e.g., right, fin and blue whales).
- Right whales and blue whales (as well as other large cetaceans present in Santa Barbara Channel) appear in the sanctuaries during specific, seasonal periods, which can be predicted with some degree of certainty.
- Large whale “songs,” such as those made by blue and humpback whales, can be accurately detected through acoustic monitoring, though several factors must be considered for detectability, including ambient noise levels, distance, species and male vs. female use of vocalizations.
- Ship advisories requesting a voluntary speed reduction had low compliance levels in both regions, and it was unclear whether ships were not receiving advisories or whether they were choosing not to respond
- Research regarding the presence of right whales through visual sightings has been conducted in SBNMS and along the Atlantic coast for approximately 15 years. Sanctuary Aerial Monitoring and Spatial Analysis Program (SAMSAP) monitoring of CINMS and the Santa Barbara Channel region has been conducted for over 10 years.

*Differences:*

- SBNMS ship strike mitigation actions have a single-species focus. CINMS has adopted a multi-species approach due to the several ESA-listed large whales present in Santa Barbara Channel region.
- Spatial area of concern: SBNMS is 638 square nautical miles and roughly rectangular in shape, while CINMS is 1,110 square nautical miles, elongate and interspersed with islands.
- Vessel traffic density: SBNMS has 3,500 large (over 300 gross tons) commercial ships that transit through their waters, whereas CINMS has approximately 6,500 large commercial ships transiting per year.
- There is a greater sense of urgency regarding the right whale population, due to their critically low population size. Estimated abundance of northern right whales is approximately 350 individuals, whereas the coastal California blue whale population numbers is approximately 1368 and the worldwide population is estimated to be over 10,000 animals (NMFS 2009).
- Ship strikes of right whales in the SBNMS have been observed over the course of many years. Ship strikes of large whales in the Santa Barbara Channel region appear to be a new phenomenon. It is unknown whether these differences are due to varying abilities to identify ship strike incidence in species other than right whales, or if other factors, such as shipping density may be at play.
- Acoustic monitoring has been ongoing in SBNMS for approximately five years. On the west coast, acoustic research is just beginning.
- Eliminating mortalities from ship strikes has been identified as a necessary action to protect North Atlantic right whales from extinction and reverse the downward trend in their population. Ship strikes have been identified as a limiting factor to the species recovery in the blue whale recovery plan, however this stock and the

population globally does not indicate a downward population trend like that of right whales.

### **Opportunities and Recommendations**

Several mitigation tools could possibly be tailored to the Santa Barbara Channel region, despite the differences between the two areas. Outreach and mariner training tools continue to be an effective means for raising awareness and disseminating prevention techniques on the east coast. The CINMS Sanctuary's Education Team (SET) is currently taking action to develop mariner training products. These outreach products and strategies will target the commercial maritime industry and other ocean-users such as fisherman, whale watching vessels and cruise ships.

The utilization of a passive acoustic monitoring array in the Santa Barbara Channel region may be prohibitively costly. The difference in size and shape of the two areas (SBNMS vs. SB Channel) may make the process more complicated to implement. However, alternative monitoring techniques may exist which can predict the presence of large whales in the SB Channel at a lower cost.

Lack of funding is hampering the implementation of monitoring programs for marine mammal and commercial vessel research. Without reliable data, actions such as the Mandatory Ship Reporting System, the Right Whale Advisory System, shifting of the TSS and the Final Ruling establishing SMAs and DMAs would not have been possible. An understanding of whale distribution within the sanctuary and the shipping lanes and where ship strikes are occurring is vital to the development of a ship strike avoidance plan.

Specifically, this case study suggests the following actions:

- Monitor annual distribution of krill, which can be affected by oceanographic conditions and is critical to predicting large whale spatial distribution.
- Continue and improve monitoring efforts to track large whale distribution (spatially and temporally) within the sanctuary and in the vicinity of the shipping lanes (e.g., AIS data, acoustic monitoring, aerial monitoring, etc.).
- Improve understanding of natural history, biology and behavior of large whales present in Santa Barbara Channel region.
- Recruit local colleges/universities to tackle research projects related to large whales and impacts of shipping traffic in the Santa Barbara Channel and greater southern California.
- Seek out additional sources of funding to continue monitoring/research efforts in the Channel Islands.

The most recent regulatory action by NMFS—the creation of SMAs, DMAs, and ATBAs along the eastern seaboard—may have some transferability to the Santa Barbara Channel region and CINMS. Large whale species in the Santa Barbara Channel region have predictable temporal behaviors (i.e. large concentrations are typically in the channel from June through September). Additionally, SAMSAP data suggests that there may be spatial

areas of greater whale aggregations. The suitability of an SMA, DMA, or ATBA, as well as a possible shift in the TSS, for the Santa Barbara Channel region needs thorough evaluation and consideration. Additionally, NOAA should continue to engage and involve the maritime industry in this process.

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## Appendix I-A

**The following timeline includes management actions carried out to protect endangered North Atlantic right whales from 1970 to the present. Management actions discussed in this paper are referred to as Management Action #.**

**1970:** North Atlantic right whales listed as endangered under the Endangered Species Conservation Act (the precursor to the Endangered Species Act (ESA)).

**1973:** North Atlantic right whales listed as endangered on the ESA and as depleted on the Marine Mammal Protection Act.

**1991:** Work on protecting North Atlantic right whales began in 1991 following completion of the recovery plan. Implementation team assembled and began a series of actions including brainstorming ways to reduce ship strikes. In 1991 there was sufficient data to indicate that ship strikes were a threat to right whales.

**1993:** Right whale sighting network began off southeast U.S. (breeding area).

**1997:**

- Right whale sighting network began off the northeast U.S. coast (foraging area). Whale sightings began to be broadcast through Notices to Mariners, Weather Service, Army Corps of Engineers, traffic controllers, web pages and through shipping agents, pilots and port authorities. (**Management Action 1**)
- NMFS began providing regular updates to the Coast Pilot about right whales, methods to avoid them, information about mandatory reporting requirement. NOAA charts are updated with right whale advisories. In 2005, this material added the ship speed advisory of 12 knots or less.
- Right whale minimum approach regulation prohibited vessels, including aircraft, from all approaches within 500 yards to minimize disturbance.

**1999:**

- Mandatory ship reporting system jointly funded by USCG and NMFS, required ships 300 tons or more to report location, speed, and destination. Information was transmitted back to ship on the location of whales. Only required in the SE and NE during periods of whale aggregations. This action helped NMFS collect information on ship traffic volume, routes, and speed to assist in analysis of measures to reduce ship strikes. (**Management Action 2**)
- Throughout the 1990s NMFS was conducting research on right whales, along with the Center for Coastal Studies, Stellwagen Bank NMS, and other organizations.



- NMFS determined that the regulations were necessary because despite conservation efforts, right whale deaths from ship strikes over the ten year period continued.

**1999-2001:** Ship strike working group was established and meetings held resulting in over 100 recommended measures, regulatory and non-regulatory, to reduce ship strike mortalities. Information used included distribution and occurrence of known ship strikes, data on right whale distribution, aggregations and migrations along coast, vessel traffic patterns, input from stakeholder groups.

**2001:** Surveys of human use patterns and baleen whale sightings were conducted by SBNMS to determine how fishing activity impacts whales in the region. (**Management Action 3**)

**2003:** SBNMS conducts study of compliance by whale watching vessels to voluntary whale approach guidelines. (**Management Action 4**)

**2004:**

- NMFS issues an Advanced Notice of Proposed Rule Making to inform the public of the agency's plan to issue regulations for fishing and shipping within areas occupied by right whales in order to reduce serious injuries and mortalities of whales.
- SBNMS begins monitoring right whales through tagging and passive acoustic monitoring devices. (**Management Action 5 & 6**)

**2006:** NMFS issues a proposed rule that would require vessels (larger than 65 ft) to slow to 10 knots at certain times and in areas where interactions between right whales and ships are considered most likely, based upon the years of ship strike observations in the Atlantic. (**Management Action 7**)

**2007:**

- NMFS creates education/outreach products for mariner training, including "A Prudent Mariner's Guide to Right Whale Protection." (**Management Action 8**)
- A negotiation between NOAA, USCG and International Maritime Organization allows a shift of the Boston Traffic Separation Scheme (TSS) in order to reduce whale-vessel interactions. (**Management Action 9**)

**2007-2010:** Passive acoustic monitoring of the areas in and around SBNMS allows more accurate detection of right whale presence. LNG carriers have agreed to reduce speed in zones where the surface buoy has indicated right whale presence within the last 24 hours. (**Management Action 10**)

**2008:** Final Rule is published (went into effect January 2009) with mandatory vessel speeds for specific times and areas of the southeast, central, and northeast U.S. (**Management Action 11**)

## CASE STUDY II: Vessel Management Tools to Reduce the Risk of Humpback Whale Harassment, Injury and Mortality in Glacier Bay National Park, Alaska



Figure 10. Glacier Bay National Park. (Source: GLBA)

### Introduction

The humpback whale (*Megaptera novaeangliae*) was classified as an endangered species in 1973, the same year that Congress passed the Endangered Species Act (ESA). Before being exploited by the commercial whaling industry, the Central North Pacific humpback population was estimated to number between 15,000 and 20,000 individuals. When commercial whaling ended in 1966, the population size was estimated at approximately 1,000 animals (Rice 1978). It has since risen to just under 20,000 in 2008 (Calambokidis et al. 2008). The humpback whale remains endangered under the ESA, yet has been down-listed to a species of “Least Concern” by the International Union for the Conservation of Nature (Reilly et al. 2008). Current human threats include vessel strikes, behavioral modification from vessel traffic, disturbance from anthropogenic underwater noise, habitat degradation, climate change, and fishing gear entanglement.

The Central North Pacific stock of humpback whales migrate between winter/spring mating and calving areas in the Hawaiian Islands and summer/fall feeding areas in northern British Columbia, Southeast Alaska, and Prince William Sound west to Unimak Pass (Angliss and Outlaw 2005). The number of whales that made up the Southeast Alaska feeding aggregation in 2000 was approximately 961 individuals, which was calculated using mark-recapture models (Straley et al. 2009). The most recent population estimate is approximately 3,000-5,000 as

determined by the Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific, or SPLASH program (Calambokidis et al. 2008). Of those 3,000-5,000 humpback whales, approximately 150 are documented in both Glacier Bay and Icy Strait. Approximately 90% of the humpback whales (excluding calves) documented in Glacier Bay and Icy Strait in 2008 have been sighted there in previous years, indicating that many of the whales in Southeast Alaska show a high level of fidelity to relatively small summer feeding areas (Neilson and Gabriele 2008).

Glacier Bay National Park (the “Park” or “GLBA”) (Figure 10) first observed the potential negative impacts of vessel traffic on humpback whales as early as 1978, when researcher Charles Jurasz documented that a significant proportion of the whales he had been monitoring abruptly left Glacier Bay in the middle of the summer. This decline coincided with a significant increase in cruise ship, recreational vessel and fishing traffic use in the region, and therefore vessel traffic was thought to be the primary deterrent to whale visitation (Jurasz and Jurasz 1979). Since that time, the National Park Service, with consultation from the National Marine Fisheries Service (NMFS), has been working to manage vessel traffic in the Park.

Currently, vessels are managed in the Park through a thorough permitting process, which only allows a maximum of two cruise ships in Glacier Bay proper each day during the summer and caps the numbers of permitted tour, charter, and private vessels to a total of 34 vessels per day. In addition, vessel operating restrictions such as speed limits and course restrictions are enforced in designated “whale waters” (any area of Glacier Bay with a high probability of whale presence, as determined by past patterns of occurrence, or recent sightings). Finally, throughout the Park, humpback whale approach regulations are intended to minimize whale disturbance and lower the risk of whale/vessel collisions (36 CFR Part 13). Regulatory actions have been fairly effective, though two fatal ship strikes have occurred, one in 2001 and one in 2004. Four non-lethal ship strikes occurred in Glacier Bay during this time period as well (Gabriele et al. 2007).

### **Regional Context**

Glacier Bay National Park contains 940 square nautical miles of marine waters surrounded by tidewater glaciers and snow-capped peaks. The Park is located in Southeast Alaska, and although it is near to Juneau, it has no road or year-round ferry access. Sea kayaks, cruise ships and private boats are the three main avenues for visitation, though cruise ships account for the majority of the tourism traffic.

Humpback whales migrate seasonally to the Park to feed on small schooling fish such as sand lance, juvenile walleye pollock, capelin, and Pacific herring, which thrive in the cold, nutrient-rich waters of the Park. Humpback whales were first reported as early as 1899 in the area and persisted until around 1976, when tourism began to flourish in the Park, increasing 66% in only four years (Catton 1995).

During the summers of 1978 and 1979, many of the humpback whales being monitored by Jurasz appeared to have abandoned the Park, causing great concern and controversy amongst managers, commercial operators, and environmentalists in the community. The National Park Service increased their monitoring efforts and sought ways to limit vessel access. NMFS was

contacted for a Section 7 consultation under the Endangered Species Act to supply a Biological Opinion, which would justify temporary regulations limiting vessel entry and behavior.

In 1979, interim whale waters speed limits and a ¼ mile approach regulation were implemented. Temporary regulations to address vessel traffic went into effect in 1980. The cruise ship industry reacted strongly, sparking the beginning of several years of debate between the Park, the Reagan administration and the cruise ship industry (Catton 1995). In 1985, after the rendering of a second Biological Opinion by NMFS, whale waters restrictions, vessel operating procedures and the vessel quota system were all codified into the GLBA Special Regulations, CFR Title 36, Subpart N (GLBA 2003).

In May 1996, regulations were amended to establish a new vessel quota system, boat operating requirements and other risk prediction measures. The quota system allowed a 20% increase in the number of vessels. The regulations were supported by an Environmental Assessment (EA), a vessel management plan and a third NMFS Biological Opinion. These documents declared a “Finding of No Significant Impact” (FONSI) with this increase in vessel quotas (NPS 2009).

In 1997, the National Parks and Conservation Association (NPCA) filed suit against the Park, demanding that a full Environmental Impact Statement (EIS) be prepared, rather than just an EA. After a lengthy battle, the Ninth Circuit Court of Appeals determined that the regulations did indeed violate the National Environmental Policy Act (NEPA). By 2001, traffic levels returned to pre-1996 levels. A full EIS was conducted in 2003 and a revised rule allowing an increase of 10% in cruise ship permit issuance (at the Superintendent’s discretion) was codified in Final Rule Vol. 71, No. 230.

### **Management Actions**

There are four management actions currently in use by GLBA to mitigate the effects of vessel traffic on humpback whales:

- 1) Research and Monitoring Programs
- 2) Glacier Bay Special Regulations:
  - Whale Waters Restrictions
  - Vessel Operating Procedures
  - Vessel Permitting System

A summary of each management action follows. The Key Contacts and Reference section provides links to additional information.

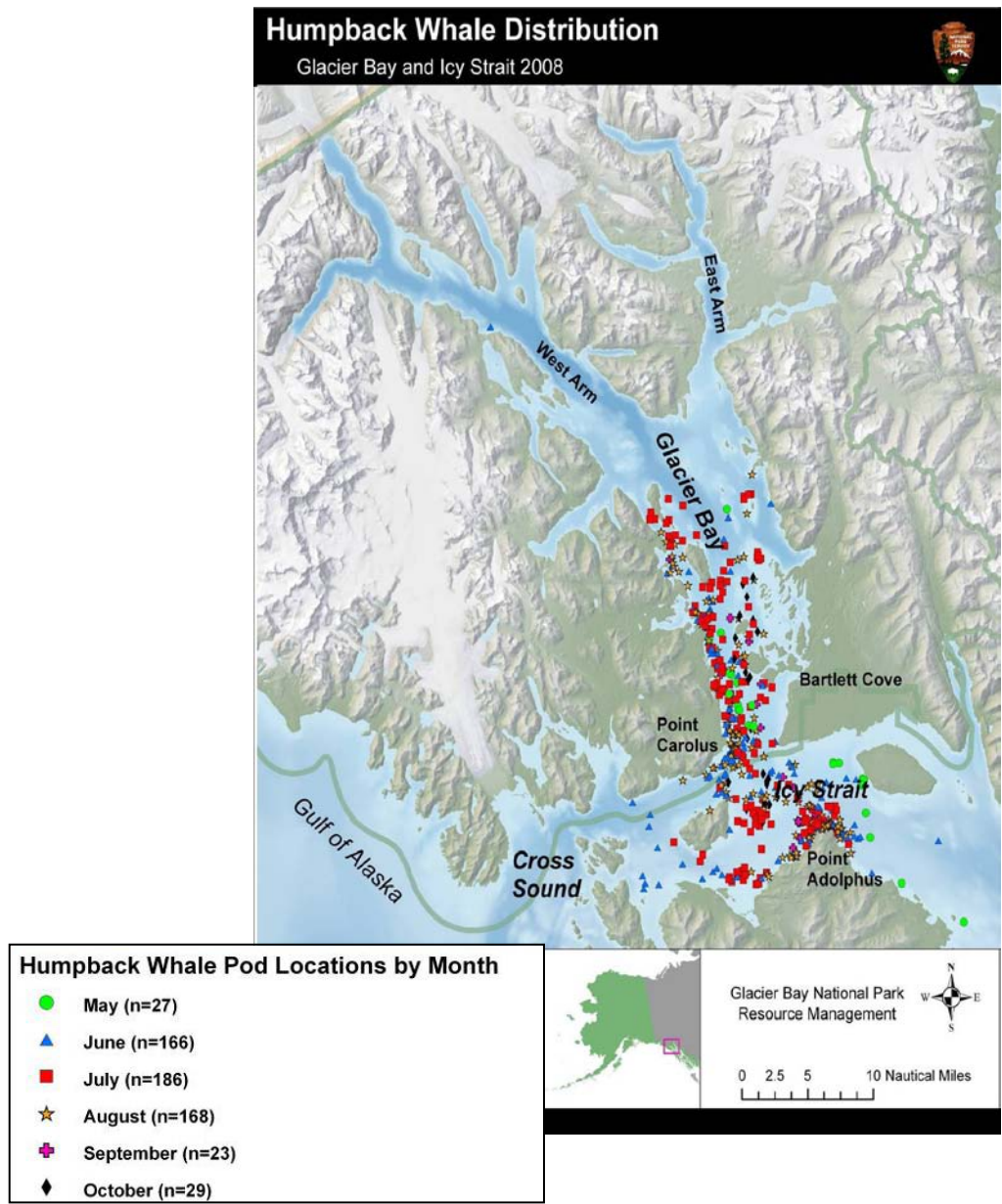
#### **1. Research & Monitoring Programs, 1981-Ongoing**

The National Park Service (NPS) allocated \$275,000 for research in fiscal year 1981, and \$350,000 the following year. These first research contracts were awarded through the NMFS National Marine Mammal Laboratory. They were completed in 1983, and marked the beginning of significant resources going into humpback whale monitoring and research. Park-sponsored research in the early 1980s focused on prey species abundance, underwater acoustic monitoring and whale/vessel interactions (Catton 1995).

One of the most definitive studies showing humpback whale behavioral changes in relation to vessel proximity is Baker and Herman (1989). The study showed that “changes in the whales’ respiratory behavior and orientation were the most sensitive indicators of vessel disturbance. Whales responded to the close proximity of vessels by decreasing blow intervals, increasing dive times, and moving away from the vessels’ path [...] Overall, whales exhibit a considerable degree of short-term changes in their behavior in response to vessel traffic” (Baker and Herman 1989). This research is still the guiding science behind current policy for whale/vessel interactions within the park.

More recent studies of interactions between humpback whales and whale watching boats have resulted in various conclusions. Some studies have shown correlations with short-term behavior changes in humpback whales when approached by boats (Corkeron 1995, Stamation et al. 2010, Scheidat et al. 2004, Watkins 1986), while others have not found impacts (Au and Green 2000). The only study of population level impacts (i.e. long-term) showed no negative impact (Weinrich and Corbelli, 2009)

GLBA began systematically (as opposed to opportunistically) monitoring humpback whales in Glacier Bay and the adjacent waters of Icy Strait in 1985 and the program has continued every year since then using the same basic methods. Photographs are taken of the underside of each whale’s flukes to identify and document individuals, as well as their residence times, spatial and temporal distribution, feeding behavior, and reproductive parameters. The data from this program are also used to inform whale waters vessel restriction decisions (see Management Action 2: Whale Waters Restrictions).



**Figure 11.** Study area in Glacier Bay and Icy Strait showing distribution of humpback whale pods in 2008. Each symbol represents a pod containing one or more whales. (Source: GLBA)

These data show that whales tend to stay within half a mile of shore in the Park and that many individuals return to the area over multiple seasons. Humpback whales are primarily concentrated in the lower and middle parts of Glacier Bay (Figure 11), which is also where vessel traffic heading up and down the bay is concentrated (by the natural bottleneck of the fjord system - see Figure 12). The whale visitation rates from 1985-2008 have varied, with an overall increasing trend. In Glacier Bay the initial count in 1985 was 15 individuals, and the maximum number of whales seen during 13 year time period was 111 in 2004. In Icy Strait the initial count in 1985 was 30 individuals, and the maximum number of whales was 136 in 2008 (Neilson and Gabriele 2008).

## **2. Glacier Bay Special Regulations**

### **a. Whale Waters Restrictions, 1979-Ongoing**

Whale waters areas are subject to vessel speed and course restrictions for the purpose of reducing impacts on feeding humpback whales. These restrictions were created in 1979 and remain similar in structure to current Park management regulations, though the number of designated whale waters areas and the dates the restrictions are in effect have changed over time (GLBA 2003). Whale waters are any area of Glacier Bay with a high probability of whale presence, as determined by past patterns of occurrence, or recent sightings. Permanent whale waters go into effect every summer season (see Appendix B for exact dates) and are located in lower Glacier Bay (Figure 12). When travelling in whale waters, vessels must operate at speeds less than 20 knots, and the Superintendent can reduce this maximum speed when deemed necessary. In addition to the permanent whale waters, the Superintendent can also establish temporary whale waters, in which vessels are required to slow-down to 10 knots or less, specifically where whales are sighted in high concentrations. Furthermore, vessels 18 feet (5.5 meters) or larger must maintain a distance of at least one nautical mile from shore in whale waters and in narrow areas must remain in mid-channel (36 CFR Subpart N, 13.1174). See Appendix B for the GLBA Special Regulations regarding Whale Waters Restrictions.

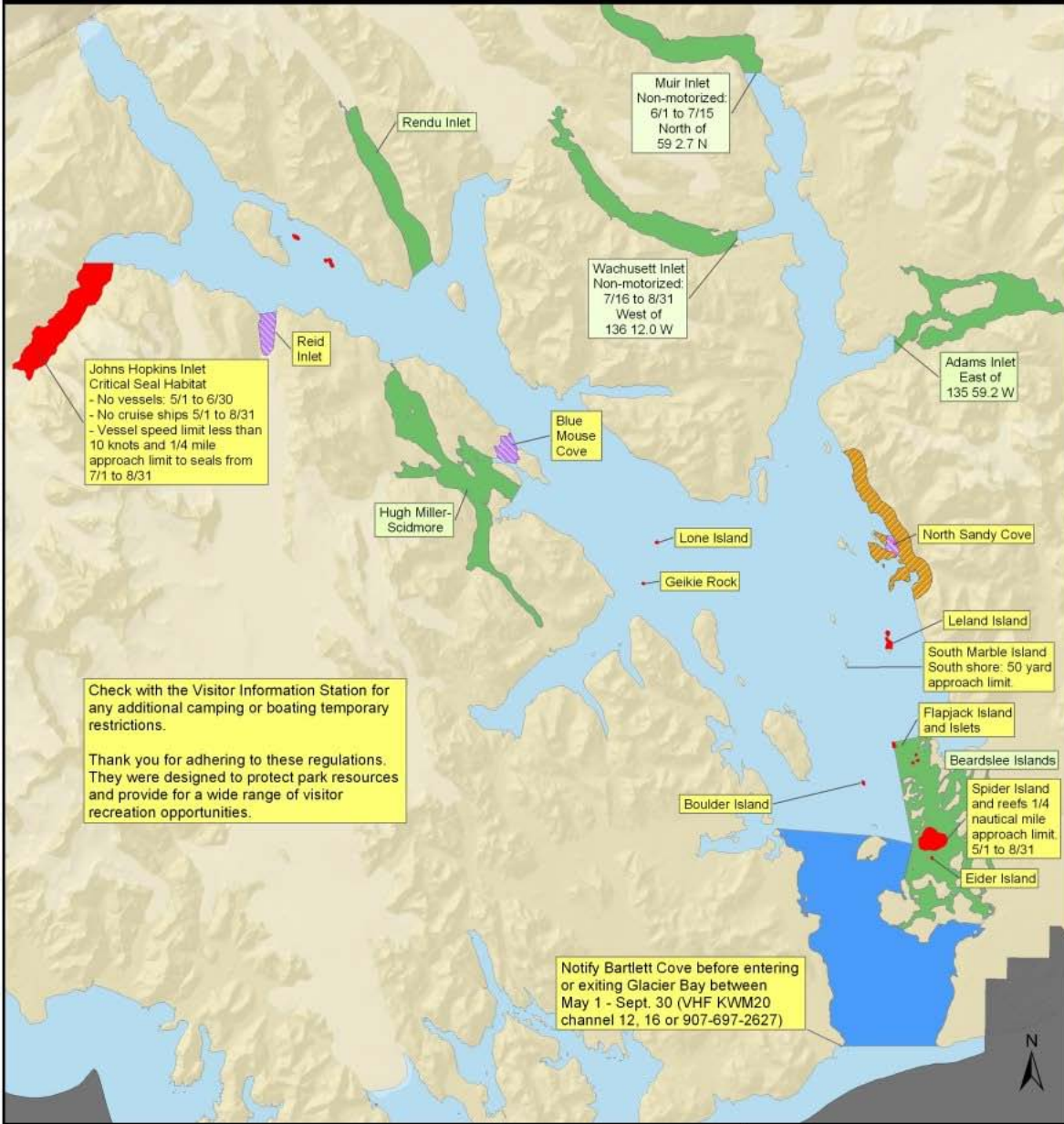
### **b. Vessel Operating Restrictions, 1985-Ongoing**

As specified in the Vessel Operating Restrictions of GLBA, Code of Federal Regulations Title 36, Subpart N, 13.1170:

- (a) Operating a vessel within  $\frac{1}{4}$  nautical mile of a [humpback] whale is prohibited, except for a commercial fishing vessel authorized under this subpart that is actively trolling, setting or pulling long lines, or setting or pulling crab pots.
- (b) The operator of a vessel inadvertently positioned within  $\frac{1}{4}$  nautical mile of a [humpback] whale must immediately slow the vessel to ten knots or less, without shifting into reverse unless impact is likely. The operator must direct or maintain the vessel on as steady a course as possible away from the whale until at least  $\frac{1}{4}$  nautical mile of separation is established. Failure to take such action is prohibited.
- (c) The operator of a vessel or seaplane positioned within  $\frac{1}{2}$  nautical mile of a [humpback] whale is prohibited from altering course or speed in a manner that results in decreasing the distance between the whale and the vessel or seaplane.

# Boating Guide

Glacier Bay National Park and Preserve  
National Park Service  
U. S. Department of the Interior



- Non-motorized waters: 5/1 to 9/15 except as noted.
- Critical wildlife areas: year round closure except as noted. Approach no closer than 100 yards except as noted.
- Noise restrictions: 10:00 pm to 6:00 am from 6/1 to 8/31.
- Overnight camping closures: 5/1 to 8/15 due to high bear concentrations.
- Park waters

### Whale Waters

Vessel route and speed restrictions apply:

May 15 - Sept. 30

### Glacier Bay National Park and Preserve

Please contact the Visitor Information Station for more information on boating in Glacier Bay.  
<http://www.nps.gov/glba>  
907-697-2627



Nov. 2007

Figure 12. Map indicating location of whale waters. (Source: GLBA)



### **c. Vessel Permitting System, 1981-Ongoing**

A vessel permit system was first introduced to GLBA in 1981 by the Superintendent in response to increasing vessel traffic and demands for whale protection by the community and environmental groups. The permit system established a quota of no more than 89 cruise ships over the season (June, July, August) and a maximum of two cruise ships per day (Catton 1995). See Appendix C for the GLBA Special Regulations for vessel permitting.

Today, the Park's permitting process is designed to protect not only marine mammals, but also to reduce air, water and noise pollution from cruise ships within GLBA boundaries. Cruise ships must have a Concession Contract, Permit, or Commercial Use Authorization (CUA) in order to enter GLBA (Federal Register 2006). A cruise ship, according to 36 CFR 13.1102, is any motor vessel of at least 100 tons gross (domestic) or 2,000 tons gross (International Convention System) certified to carry more than 12 passengers for hire.

New vessel regulations were created in 2007 based on the 2003 EIS. The new regulations divide quota periods into two separate sessions (a prime and shoulder season) and increase the quota for both periods by 10%. Beginning in 2007, the prime season (June, July, August) quota increased from 139 to 153 entries or "use days." Shoulder season entries are at 92 use days. "These seasonal quotas are reviewed annually by the Superintendent and may be reduced or increased (to a maximum of two per day, every day) as needed to protect park values and purposes" (36 CFR 13.1160).

There are also daily limits to the amount of cruise ships allowed in Glacier Bay at any one time. Currently, no more than two cruise ships per day are permitted to be inside Glacier Bay proper (Federal Register 2006). In addition, the permit system requires that all vessel operators attend an orientation with park rangers that elaborates on the need to protect whales from disturbance (Janet Neilson, Glacier Bay National Park and Preserve, pers. comm.). All cruise ships applying for a permit must also address underwater noise reduction, as well as vessel emissions. See Appendix D for relevant sections of the Cruise Ship Concession Permit Application.

### **Analysis: Potential Application to the Santa Barbara Channel Region**

This section analyzes the extent to which the management actions in GLBA can be applied to the Santa Barbara Channel region. There are multiple lessons to be learned from the management strategies of GLBA. Management actions transferable to Santa Barbara Channel region include seasonal management areas (SMAs) and regulatory action controlling vessel behavior within Park boundaries.

#### *Similarities:*

- Biodiversity hotspots (both GLBA and CINMS are located in areas with endangered species and valued ecosystems).
- Humpback whales and blue whales (as well as other ESA-listed large cetaceans in Santa Barbara Channel region) appear in the regions during specific seasonal periods, which can be predicted with some degree of certainty.
- Thriving tourism and whale watching in both locations (though traditional whale watching is prohibited in GLBA by the Park's strict humpback whale approach regulations).

- All federal agencies have a mandate to protect species and habitat within their boundaries under the ESA.
- Seasonal overlap in vessel traffic with whale feeding areas.

*Differences:*

- GLBA ship strike mitigation actions have a single-species focus. CINMS has adopted a multi-species approach due to the several ESA-listed large whales present in Santa Barbara Channel region.
- GLBA has jurisdiction over its marine waters, which allows the Park to control access and vessel behavior within the Park. NMFS has the authority to control access and vessel behavior within Santa Barbara Channel.
- GLBA is not subject to commercial shipping traffic.
- Spatial area of concern: Both locations are roughly equivalent areas (CINMS is 1,110 nm<sup>2</sup> and GLBA is 940 nm<sup>2</sup>). However, access is extremely limited to GLBA, whereas the Santa Barbara Channel is the most heavily trafficked marine highway in the nation.
- Humpback whales tend to stay within ½ NM of shore when within GLBA. Other ESA-listed large whales have varying behaviors that are species and season dependent.

**Opportunities and Recommendations**

Some mitigation tools utilized by GLBA could possibly be tailored to the Santa Barbara Channel region, despite the differences between the two locations. As in the Stellwagen Bank Case Study, spatial and temporal management of vessel behavior may be appropriate for Santa Barbara Channel region. ESA-listed species present in the Santa Barbara Channel region do not have regular fine-scaled spatial predictability, though they do have predictable temporal behaviors (e.g., blue whales are in the SB Channel from May through October).

Cruise ships are the greatest threat to whales in GLBA, whereas commercial shipping constitutes the bulk of the vessel traffic in the Santa Barbara Channel. The regulation of international commercial traffic in federal waters is more complex than the regulation of cruise ships within GLBA waters. Cruise ships entering GLBA must meet all the requirements of the permit applications, which are handled solely by the Park Service. Glacier Bay proper has no outlet and only one entry point, making for simplified regulation and enforcement. Also, the geography of the area excludes it from functioning as a transit route. It therefore has no Traffic Separation Scheme (TSS) in its waters. However, the responsive and flexible nature of the GLBA regulations could be applied to the CINMS and Santa Barbara Channel region.

Based on this case study, the following actions and monitoring programs may advance the goals of the Ship Strike Subcommittee and CINMS:

- Continue and improve on systematic monitoring efforts to track vessel and ESA-listed large whale distribution (spatially and temporally) within the sanctuary and in the vicinity of the shipping lanes (e.g., AIS data, acoustic monitoring, aerial monitoring, etc.).
- Seek out additional sources of funding to continue monitoring/research efforts in the Channel Islands.
- Create education and outreach products for the maritime industry, as well as involve industry in policy formation.

- Investigate regulatory actions such as the Whale Waters Restrictions for required seasonal slow-downs in specific areas of the Santa Barbara Channel.

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## **Appendix II-A: Timeline**

### **1973:**

- Congress passes Endangered Species Act.
- North Pacific humpback whale classified as endangered.

### **1979:**

- Whale Management Report (Charles and Virginia Jurasz and Gregory P. Streveler).
- Humpback Whales in Glacier Bay National Monument, Alaska: Report on the Interagency Review Meeting, Seattle, Washington, on 12-13 October, 1979 (Marine Mammal Commission).
- First biological opinion rendered by NMFS (Letter, Jerry T. Leitzell to John F. Chapman, December 3).
- First interim whale management plan created for GLBA. Included a permitting system and “whale waters” policies.

**1983:** Second biological opinion rendered by NMFS.

### **1985:**

- GLBA Special Regulations Codified: 36 CFR 13.65.
- GLBA begins systematically monitoring humpback whale population.

**1987:** Humpback Whales in Glacier Bay, Alaska: A long-term history of habitat use (Gary M. Vequist and C. Scott Baker).

**1996:** GLBA Special Regulations Amended- Regulations passed to increase quota system based on an Environmental Assessment.

**1997:** NPCA files suit against NPS.

**2001:** Quota returns to 1996 levels.

**2003:** Full EIS conducted.

**2004:** GLBA Special Regulations most recent re-authorization.

**2007:** Revised rule enacted to increase cruise ship quota in GLBA by 10%.

## **Appendix II-B: Title 36 Code of Federal Regulations, Subpart N § 13.1174 Whale water restrictions**

(a) May 15 through September 30, the following waters are designated as whale waters:

(1) Waters north of a line drawn from Point Carolus to Point Gustavus; and south of a line drawn from the northernmost point of Lars Island across the northernmost point of Strawberry Island to the point where it intersects the line that defines the Beardslee Island group, as described in §13.1180(a)(4), and following that line south and west to the Bartlett Cove shore (so as to include the Beardslee Entrance and Bartlett Cove); and

(2) Other waters designated by the superintendent as temporary whale waters.

(b) The public will be notified of other waters designated as temporary whale waters in accordance with §1.7 of this chapter.

(c) Violation of a whale water restriction is prohibited. The following restrictions apply in whale waters unless otherwise provided by the superintendent in the designation:

(1) Operating a motor vessel less than one nautical mile from shore (where the width of the water permits), or in narrower areas navigating outside of mid-channel is prohibited. This restriction does not apply to motor vessels less than 18 feet in length, or vessels actively engaged in fishing activities or operating solely under sail.

(2) Unless other restrictions apply, operators may perpendicularly approach or land on shore (*i.e.*, by the most direct line to shore) through designated whale waters, but they may not transit along the shore.

(3) Operators must follow motor vessel speed limits in §13.1176(a).

### **§ 13.1176 Speed restrictions.**

(a) From May 15 through September 30, in designated whale waters the following are prohibited:

(1) Operating a motor vessel at more than 20 knots speed through the water; or

(2) Operating a motor vessel at more than 13 knots speed through the water, when the superintendent has designated a maximum speed of 13 knots, or at a maximum speed designated by the superintendent based on NOAA guidelines or new scientific information.

(b) From July 1 through August 31, operating a motor vessel on Johns Hopkins Inlet waters south of 58°54.2' N latitude (a line running due west from Jaw Point) at more than 10 knots speed through the water is prohibited.

## **Appendix II-C**

### **§ 13.1150 Is a permit required for a vessel in Glacier Bay?**

A permit from the superintendent is required for motor vessels in accordance with this subpart and applicable regulations in this part.

### **§ 13.1152 Private vessel permits and conditions**

In Glacier Bay from June 1 through August 31 an individual must have a permit from the NPS issued for a specific vessel for a specific period of time.

- (a) From June 1 through August 31, when the operator of a private vessel enters Glacier Bay for the first time that calendar year, the operator must go directly to the Bartlett Cove Ranger Station for orientation.
- (b) From May 1 through September 30, the operator of a private vessel must immediately notify the Bartlett Cove Ranger Station of the vessel's entry to or exit from Glacier Bay.

### **§ 13.1154 Commercial vessel permits and conditions**

Each commercially operated motor vessel must have a permit to operate in Glacier Bay National Park and Preserve in accordance with §5.3 of this chapter.

- (a) A cruise ship must have a concession contract to operate in Glacier Bay.
- (b) A tour vessel, charter vessel, and passenger ferry must have a commercial authorization to operate in Glacier Bay.
- (c) The operator of a cruise ship, tour vessel, charter vessel, and passenger ferry must notify the Bartlett Cove Ranger Station of the vessel's entry into Glacier Bay within 48 hours in advance of entering Glacier Bay or immediately upon entry.
- (d) Cruise ships and tour vessels are prohibited from operating in the Beardslee Entrance and at the entrance to Adams Inlet, as defined as waters within the Wilderness boundaries in those respective areas.
- (e) Off-boat activity from a cruise ship, tour vessel, or charter vessel is prohibited, unless authorized by the superintendent.
- (f) Off-boat activity from a passenger ferry is prohibited, except for passenger access at the Bartlett Cove docks.
- (g) A passenger ferry must travel a direct course between the mouth of Glacier Bay and Bartlett Cove, except when the vessel is granted safe harbor by the Superintendent as stated in §13.1156(e).

### **§ 13.1156 Exceptions from vessel permit requirement**

A vessel permit is not required in Glacier Bay when:

- (a) A motor vessel is engaged in official, non-commercial business of the State or Federal Government.
- (b) A motor vessel is operating in Bartlett Cove waters east of a line extending from the long axis of the fuel dock to the wilderness boundary of Lester Island.

- (c) One motor vessel is launched from a motor vessel that has a permit and only while the authorized motor vessel remains at anchor or operated in accordance with a concession agreement from a permitted motor vessel while that vessel is not underway.
- (d) A commercial fishing vessel authorized under this subpart is actually engaged in commercial fishing; or
- (e) A vessel is granted safe harbor by the superintendent.

**§ 13.1158 Prohibitions.**

- (a) Operating a motor vessel in Glacier Bay without a required permit is prohibited.
- (b) Violating a term or condition of a permit or an operating condition or restriction issued or imposed pursuant to this chapter is prohibited.
- (c) The superintendent may immediately suspend or revoke a permit or deny a future permit request as a result of a violation of a provision of this chapter.

**§ 13.1160 Restrictions on vessel entry.**

The superintendent will allow vessel entry in accordance with the following table:

**Table 1. Vessel entry restrictions to Glacier Bay National Park**

<b>Type of vessel</b>	<b>Daily vessel quotas (DVQ)</b>	<b>Period covered by DVQ</b>	<b>Seasonal vessel quota (SVQ)</b>	<b>Period covered by SVQ</b>
Cruise ship	2	Year-round	Up to 184	June 1–August 31.
			Up to 122	May and September.
Tour vessel	3	Year-round	N/A	N/A.
Charter vessel	6	Jun 1–Aug 31	N/A	N/A.
Private vessel	25	Jun 1–Aug 31	N/A	N/A.
Passenger ferry	1	Year-round	N/A	N/A.

Note: Cruise ships and tour vessels are limited to the daily vessel quota year-round. Charter and private vessels are not subject to quotas from September through May.

- (a) The Director will reduce the vessel quota levels for any or all categories of vessels in this subpart as required to protect the values and purposes of Glacier Bay National Park and Preserve. The director will make these reductions based on the controlling biological opinion issued by the National Oceanic and Atmospheric Administration Fisheries Service under section 7 of the Endangered Species Act, applicable authority, and any other relevant information.



(b) The superintendent will annually determine the cruise ship quota. This determination will be based upon applicable authorities, appropriate public comment and available scientific and other information. The number will be subject to the maximum daily vessel quota of two vessels.

(c) From June 1 through August 31, the superintendent will designate one private vessel permit from the daily quota of 25 as a transit permit. This transit permit may be used only to directly exit Glacier Bay from Bartlett Cove and return directly to Bartlett Cove. The superintendent may establish application procedures and operating conditions. Violating operating conditions is prohibited. This paragraph will cease to have effect on November 30, 2011.

(d) Nothing in this section will be construed to prevent the superintendent from taking any action at any time to protect the values and purposes of Glacier Bay National Park and Preserve.

## Appendix II-D: GLBA Cruise Ship Concession Permit - Environmental Objectives

**Note to Officer:** This selection factor is concerned with environmental objectives that relate specifically to protection of particular resources of the park area. Environmental objectives that promote the natural environment *in general* (waste reduction, fuel efficiency, recycling, etc.) are addressed under *secondary selection factor 1*. Please avoid overlap between the response here and the response to *secondary selection factor 1*.

A primary objective of the National Park Service is the protection of park resources. Some potential environmental issues related to cruise ship services include:

- Air quality impacts due to stack emissions;
- Water quality issues due to discharge of waste, toxicity of anti-fouling systems and petroleum spills; and
- Impacts due to ship generated noise.

### Subfactor 1a. Air Quality

- 1) Describe the equipment and technology for controlling or minimizing air pollution emissions to be utilized by each vessel you propose to operate in the park.
- 2) Describe operational methods which would be employed to minimize air pollution emissions for each vessel you propose to operate in the park including engine, generator, and incinerator operations.
- 3) Describe the opacity monitoring mechanisms in place for each vessel you propose to operate in the park. Please specify how opacity data is recorded, if an opacity alarm is in place, the alarm level and the standard operating procedures for responding to the alarm.
- 4) Will you provide the park with the opacity monitoring data? If so, describe the format you will use (electronic, paper printouts, etc.) and how long the information will be available. A better proposal may commit to retaining this information for at least a year and making it available to the NPS on request...
- 5) Provide the information indicated on the following Propulsion Engine Data form for each propulsion engine you propose for service in Glacier Bay. For propulsion systems based on technology other than compression ignition diesel engines (e.g. gas turbine, steam, solar, sail, etc.), specify the specific emissions standards (if any) met by the alternative propulsion system or provide certified emissions levels for (1) THC+NOX g/kW-hr.; (2) CO g/kW-hr.; and (3) PM g/kW-hr. if available. A better proposal may utilize propulsion systems which minimize emissions of these and other pollutants.

For diesel engine, please refer to 40 CFR Part 94 Sec. 8.

Ship Name:

Engine Make:

Engine Model:

No. of Engines Installed:

EPA Engine Category:

EPA Emissions Rating:

Engine Power Rating:

Glacier Bay Usage (%):

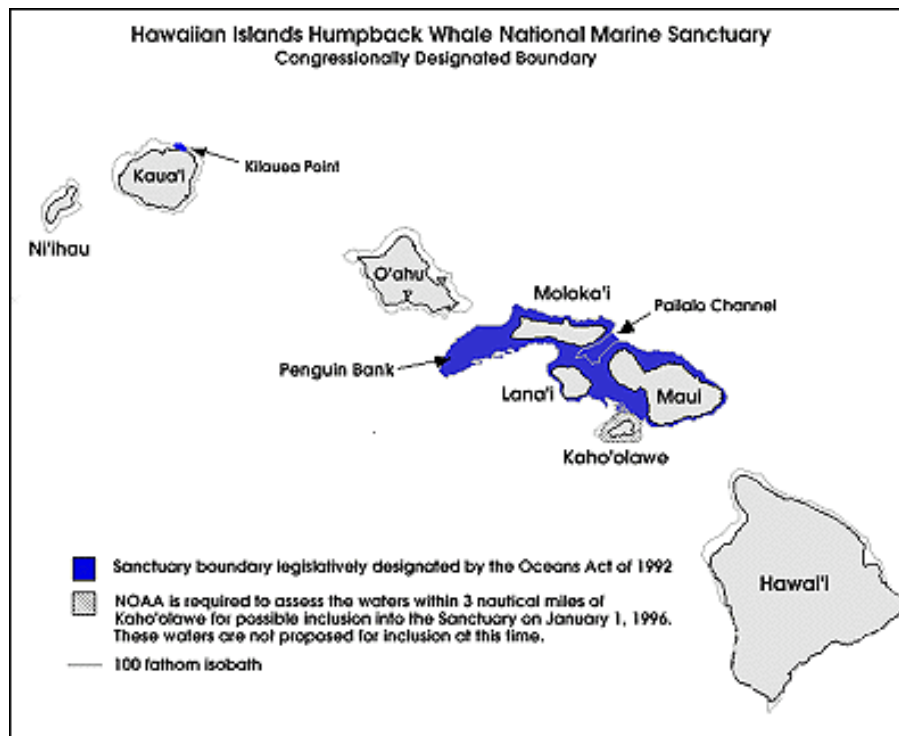
### **Subfactor 1b. Water Quality**

- 1) Will operations involve any discharge into the waters of Glacier Bay National Park (not just the bay proper), including, but not limited to, wastewater, treated and untreated sewage, grey water, ballast water, bilge water, hazardous and solid wastes? If so, describe the nature of the discharge(s) in detail including location(s), composition, toxicity, quantity, rate and frequency. A better proposal may commit to eliminating vessel discharge in all Glacier Bay National Park waters.
- 2) Will your operations involve any discharge into the waters adjacent to Glacier Bay National Park from Cross Sound to the entrance to Glacier Bay, including, but not limited to, wastewater, treated and untreated sewage, grey water, ballast water, bilge water, hazardous wastes and solid wastes? If so, describe the nature of the discharge(s) in detail including location(s), composition, toxicity, quantity, rate and frequency. A better proposal may commit to eliminating vessel discharge in the adjacent waters described above.
- 3) If the proposed operation involves any wastewater discharge into park waters, identify any wastewater treatment you will use which exceeds state or federal requirements. A better proposal (though likely not better than a commitment to eliminate discharge) may employ an advanced wastewater treatment system designed to remove the highest proportion of pathogens, pollutants, metals and organics.
- 4) Identify the hull anti-fouling system(s) for each of the vessels you propose for use. You must disclose whether you have applied organotin compounds to the hull of any of the vessels proposed for operation in Glacier Bay and, if so, whether you have applied a barrier coat (please describe the barrier coat used).
- 5) Describe on-board hazardous material spill response capability for each vessel proposed to operate in the park. Describe the type and size (length/height) of spill retention boom, quantity of absorbent material, etc. A better proposal may include appropriate training and supplies to enable ship staff to quickly and capably respond to small spills and to facilitate first response in the event of a major spill.

### **Subfactor 1c. Underwater Noise**

- 1) Describe the equipment, technology or other physical plant features designed to minimize underwater noise for each vessel you propose to operate in the park.
- 2) Describe operational methods you will employ to minimize underwater noise for each vessel you propose to operate in the park.
- 3) Will you complete underwater “sound signatures” for any of the ships proposed to operate in Glacier Bay within two years of contract award and provide the NPS with a copy of any reports within sixty days of report completion? If so, provide details including ships to be tested, type of testing, specific ships systems to be tested and the testing entity, facility and location. A better proposal may include a comprehensive testing program for all ships at an established facility.

### CASE STUDY III: *Protecting Humpback Whales by Reducing the Risk of Mortality by Ship Strike in Hawaiian Island Humpback Whale National Marine Sanctuary*



**Figure 13.** Map of Hawaiian Islands Humpback Whale National Marine Sanctuary. (Source: [www.coralreefnetwork.com](http://www.coralreefnetwork.com))

#### Introduction

The Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS) was established in 1992 with the express purpose of protecting humpback whales and their habitat. The HIHWNMS encompasses both federal and state waters and extends from the shorelines of Hawai'i to the 100-fathom isobath, and is composed of five separate marine protected areas (MPAs). The largest contiguous portion of the sanctuary, encompassing about half of the total sanctuary area, is delineated around Maui, Moloka'i, and Lāna'i. (HIHWNMS 2008a) (Figure 13).

The HIHWNMS has been aware of the threat posed by vessel traffic to humpbacks since the creation of the marine protected area. Current protection efforts are primarily upheld through state laws and mariner education programs. Additionally, the sanctuary held a Vessel Collision Avoidance Workshop in 2003 in order to discuss the issue and make recommendations for possible policy action.

In the early 2000s, plans for a Hawai'i Superferry (Figure 14) were initiated. The Superferry was planned to have two vessels operating during the day and night with routes among the islands including occasional travel through the sanctuary. In August 2007, the Superferry began operation but there were numerous legal challenges. Ultimately (after periods of on-again/off-

again operation) a Hawai'i State Supreme Court's decision pushed the Superferry to permanently discontinue operations in Hawai'i.



**Figure 14.** Photograph of the Hawai'i Superferry. (Source: [www.gcaptain.com](http://www.gcaptain.com))

There are significant differences between the events surrounding the Hawai'i Superferry and the issue of ship strikes in the Santa Barbara Channel, but both do include collaboration between NMFS and the sanctuary to help protect impacted marine species.

### **Regional Context**

Every winter, as many as 10,000 humpback whales may inhabit the waters of the sanctuary (Calambokidis et al. 2008). Humpbacks come to the warm, shallow waters of Hawai'i to mate, calve and raise their young. Mothers and calves are generally found in the shallow waters around the islands (waters shallower than 100 fathoms) although whales can be found anywhere around the islands and have been seen in the fall and into the spring. It is thought that the high visibility, calm water and lack of predators in Hawai'i make it an attractive nursery ground for humpbacks. The species is famous for their frequent vocalizations, and much acoustic work has been conducted, both in Hawai'i and other regions around the world (HIHWNMS 2008b).

Each year tons of marine debris drifts through waters surrounding the Hawaiian Islands and washes onto its shorelines, posing a threat to humpback whales. Therefore, entanglement in debris (including but not limited to, ropes, cargo nets and derelict fishing gear) is a significant threat to humpback whales that can result in injury or mortality. There is also a thriving whale watching industry in the region, with the increasing number of vessels, as well as the proximity of vessels to humpback whales continuing to be of concern to sanctuary managers. Between 1975 and 2007, NOAA confirmed 38 vessel strikes on humpback whales, with seven ship strikes in 2006, followed by six in 2007 (HIHWNMS 2008c). Four vessels, including whale watching operations, comprise over half of reported collisions between whale and vessel (Lyman 2010).

Beginning in the early 2000s, there has been much controversy and concern over high speed vessels, such as the Hawai'i Superferry. The potential for high speed vessels in Hawaiian waters continues to be a concern. The Superferry transited at speeds of up to 35 knots and often passed through sanctuary waters when weather conditions were poor.

The Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) prohibit approaching humpbacks within 100 yards or flying less than 1,000 feet over the whales to avoid takes or harassment of whales. These laws apply both within and outside of sanctuary waters.

## Management Actions

### 1) **Monitoring Programs**, Ongoing

Large scale studies of humpback whale population dynamics were conducted from 2002-2006, through the SPLASH (Structures of Populations, Levels of Abundance and Status of Humpback Whales) project. The primary objectives of the SPLASH project are to improve the description of the stock structure of humpback whales in the North Pacific, to understand the abundance, trends, and movements of these stocks, and to assess the human impact on them (Cascadia Research 2009). Sanctuary scale impacts were not an aspect of SPLASH.

Passive acoustic monitoring has also begun in order to better determine the response abundance of humpback whales in the Sanctuary.

### 2) **Mariner Training**, Ongoing

The sanctuary has developed guidelines for vessel behavior in areas where humpback whales are present. The guidelines integrate both recommendations and federal requirements for whale viewing. They include safe speed, minimum distance specifications, keeping a sharp lookout, warning other vessels of whale presence, staying at the helm at all times and other prudent mariner behaviors (HIHWNMS 2008d).

### 3) **Regulations - Federal and State**, Ongoing

#### *Hawai'i Wildlife Law*

State Law prohibits the possession, injury or killing of any indigenous or endangered animals in Hawai'i. These state laws extend endangered species protections to native species within the state (HIHWNMS 2008e).

#### *Hawaiian Islands Humpback Whale National Marine Sanctuary Act*

The HIHWNMS Act prohibits vessels from pursuing or approaching humpback whales closer than 100 yards (HIHWNMS 2008e).

### 4) **Vessel Collision Avoidance Workshop**, Sept. 3-5, 2003

In 2003 the HIHWNMS Advisory Council Vessel Strike Working Group hosted a workshop of scientists, managers, stakeholders and maritime industries to assess ship strike risks to whales in Hawai'i and to identify possible actions to reduce the occurrence of vessel/whale collisions in Hawaiian waters. The workshop included summaries of recent research and a series of breakout groups who analyzed management issues particular to three vessel classes. Vessel categories were:

- Large Commercial Vessels
- Commercial passenger and support vessels operating on a daily basis in nearshore waters of Hawaii
- Private recreation vessels

The result of the workshop was to create a list of research questions and needs, as well as to align participants' understanding of the issues and possible next steps. For a summary of the

workshop proceedings, please see:

[http://hawaiihumpbackwhale.noaa.gov/documents/pdfs\\_workshops/vessel\\_whale\\_report.pdf](http://hawaiihumpbackwhale.noaa.gov/documents/pdfs_workshops/vessel_whale_report.pdf)

## **5) Whale Avoidance Policy: Superferry**

Prior to beginning operations in Hawai'i, the Superferry developed a whale avoidance policy with measures to minimize the likelihood of hitting and injuring or killing humpback whales (Hawai'i Superferry 2005). Key vessel actions in the plan included:

### Avoidance

- Avoiding whales and never approaching them.
- Avoid traveling in waters less than 100 fathoms.
- When within sanctuary waters or waters less than 100 fathoms, operate at a maximum of 25 knots.
- Specific guidance on maneuvers to track and avoid whales.
- Ships were routed so that they would generally not travel through the sanctuary in order to limit interactions between humpbacks and the Superferry.

### Observers

- Two active officers and an additional two dedicated look-outs should be stationed on the bridge to watch for whales; these look-outs to be trained in whale sightings, behavior, and detection.
- Recommendations were provided for observation equipment.
- These included forward-looking collision avoidance sonar (although systems are not currently commercially available). X-band radar also recommended along with specific equipment for night time operations.

### Log keeping and reporting procedures

- Specific requirements for logging avoidance maneuvers, approaches closer than 100 yards, or any whale strikes.

In 2005, the HIHWNMS Sanctuary Advisory Council (SAC) voted to endorse the whale avoidance policy, although sanctuary staff did not provide their endorsement.

While the whale avoidance policy was considered a good start, NMFS did not consider it sufficient to avoid take of ESA listed humpback whales during Superferry operations. Take under the ESA is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. NMFS and HIHWNMS staff began collaborating on advice to the Superferry on ways to mitigate impacts to humpbacks.

## **Legal Issues**

In 2005, NMFS recommended that the Superferry pursue an incidental take permit (ITP), issued under Section 10 of the ESA, to permit the incidental take of humpbacks. A Section 10 permit is



required of non-federal actions that take ESA-listed species. The ITP process is complex, requiring a habitat conservation plan, National Environmental Procedures Act (NEPA) analysis, and a Section 7 consultation (on the issuance of the federal ITP). This process generally takes over a year and may take numerous years to complete.

On October 31, 2007, the Hawai'i State legislature passed a bill allowing the Superferry to continue operations if they applied for an ITP and requested NOAA observers on the vessel when it traveled through HIHWNMS waters. The Governor of Hawai'i issued an Executive Order allowing the ferry to continue to operate while the analyses for the ITP were being completed. Following passage of a State bill and Executive Order, the Superferry resumed operations in late 2007 and 2008 while analyses of its environmental impacts were written.

In March 2009, the Hawai'i State Supreme Court ruled that the law allowing operations of the Superferry was unconstitutional due in part to its limited application (applied to only one vessel) and that operations must be suspended until all environmental analyses and permits were issued. In March 2009, the Superferry ceased operations in Hawai'i following the ruling.

During limited operations in 2007 and through 2008, there were no whale strikes by the Superferry, although there were some "near misses" during the 2008 humpback season.

### **Analysis: Potential Application to the Santa Barbara Channel Region**

This section analyzes the extent to which the management actions on Hawai'i might be applied in the Santa Barbara Channel region. There are multiple lessons to be learned from the management strategies of HIHWNMS. Management actions that may be transferable to Santa Barbara Channel region include: education and outreach programs, improved monitoring efforts and Seasonal Management Areas.

#### *Similarities*

- Transits by vessels include sanctuary waters, but much travel is done outside the Sanctuary.
- Humpback whales and blue whales are listed as endangered on the ESA and are thus protected under the ESA and MMPA from take and harassment.

#### *Differences*

- More than half of ship strikes of whales in HIHWNMS are from tour vessels, including whale watching operations (Lyman 2010), while in CINMS, they appear to be from commercial shipping vessels.
- The type, speed, and operation of the Superferry is very different from vessels in the Santa Barbara Channel region.
- The vessel traffic in the Santa Barbara Channel (SBC) is much more complex than in Hawai'i. The presence of a shipping traffic, commercial fishing, as well as recreation leads to different challenges related to communication, outreach and education, voluntary compliance with recommendations, enforcement, among other issues.
- There is a much smaller economic impact of regulating one Superferry than the impacts to the shipping industry and other vessels using the SBC.

- The distribution of humpback whales is well known and predictable in time and space. Blue whale distribution in the summer is largely determined by prey distribution and abundance and is difficult to predict.
- It is much easier to model the impact of the Superferry on humpback whales than the impact of vessels on blue whales and other species in the SBC. The Superferry traveled along set routes and schedules and there was only one vessel. Also, the distribution and behavior of humpback whales is well known due to long-term studies. The shipping and other vessel traffic in the SBC is much more complex and there are no long-term studies of blue whale distribution and behavior. As noted above, blues and other whales are distributed based upon prey availability and this can change annually or inter-annually.
- Humpback whales are calving and mating in Hawai'i, blues and other ESA-listed whales are generally feeding in water off California in the summer. Calves are generally more vulnerable to ship strikes due to their need to breathe more often than adults and also because they are more difficult to sight (a newborn humpback may be 12 feet long versus an adult blue whale averaging 75 feet long).

In conclusion, the events of the Hawai'i Superferry's operation were largely driven by legal issues, the State legislature and the court, which is not the case in Santa Barbara Channel. While there are substantial differences, both situations, Hawai'i and SBC, highlight the need for collaboration between NMFS and NOS and the need to look broadly at the issues.

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## **Appendix III-A: Timeline**

**1992:** HIHWNMS created.

**2003:** HIHWNMS SAC holds Vessel Collision Avoidance Workshop to address ship strikes and identify possible actions to reduce ship strike occurrences

**2005:**

- HIHWNMS SAC endorses Superferry whale avoidance policy, Sanctuary staff did not endorse the policy.
- NMFS recommends that Superferry apply for incidental take permit (ITP).

**2007:**

- Superferry commences operations.
- Hawai'i State legislature passes bill allowing Superferry to continue if they applied for an ITP and requested NOAA observers on the vessel when it traveled through HIHWNMS waters.

**2009:**

- Hawai'i State Supreme Court ruled that the law allowing operations of the Superferry was unconstitutional.
- Superferry ceases operations in Hawai'i.

## **CASE STUDY IV: *Smog, Soot, and Cetaceans? An examination of vessel speed reduction efforts at the Ports of Los Angeles and Long Beach***



**Figure 15.** Ocean going vessel transiting the Santa Barbara Channel. (Source: Santa Barbara Air Pollution Control District)

### **Introduction**

The three previous case studies examined scenarios in which agencies and stakeholders worked to control shipping activities expressly for the purpose of protecting whales from collisions, known as ship strikes. This is the fourth in a series of case studies which describes previous and currently utilized strategies, and then analyzes these methods in terms of applicability for the Santa Barbara Channel region and Channel Islands National Marine Sanctuary region.

In contrast, this study examines ongoing efforts by the Ports of Los Angeles and Long Beach (the entities comprising the San Pedro Bay Ports (Ports)), in collaboration with the Marine Exchange of Southern California, the US Environmental Protection Agency (EPA), the California Air Resources Board (CARB), the South Coast Air Quality Management District (AQMD), and shipping industry representatives to reduce air pollution (Figure 15) within the South Coast Air Basin, a multicounty area managed by the South Coast AQMD (Figure 16). Two related efforts comprise this report's focus, namely specific components of the San Pedro Bay Ports Clean Air Action Plan (CAAP) from 2006, and the Port of Long Beach's dockage incentive program associated with the Ports' voluntary Vessel Speed Reduction (VSR) program, initiated in 2001.

## Regional Context

According to the CAAP, the South Coast Air Basin “has some of the worst air quality in the nation, which represents a major health concern for its residents” (Port of Los Angeles & Port of Long Beach 2006). Because the Ports of Los Angeles and Long Beach and the array of activities centered around them (e.g., shipping, trucking, rail lines, and other diesel-burning operations) are major sources of toxic air pollution within the Basin, stakeholder agencies developed the 2006 CAAP to address and reduce pollution in a comprehensive and systematic way.

The CAAP and voluntary VSR are relevant to the issue of reducing the risk of ship strikes in the Santa Barbara Channel because in order to reduce pollution, the Ports have effected measurable slowing of vessel traffic in 20 and 40 nautical mile (nm) zones around the Ports (centered at Point Fermin, to the immediate southwest of the actual Ports complex), and global data indicates a clear nexus between the speed of commercial ship traffic and the risk of harmful and fatal collisions with whales.



**Figure 16.** Delineation of Southern California air basins and the jurisdiction of South Coast AQMD. (Source: South Coast Air Quality Management District.)

According to investigators of ship strike statistics, “[t]he correlation between today’s fast ships and the increase of whale ship-strike incidences has been firmly established... fatal ship strikes were rare before the 1800s, were infrequent until 1950, and have since increased steadily with the number of ships and the greater speeds of ship travel” (Douglas et al. 2008). More specifically, “most lethal or severe injuries are caused by ships 80 m or longer; whales usually are not seen beforehand or are seen too late to be avoided; and most lethal or severe injuries involve ships traveling 14 knots or faster. In areas where special caution is needed to avoid such events, measures to reduce the vessel speed below 14 knot may be beneficial” (Laist et al. 2001).



**Figure 17.** Excerpted map depicting the three traffic lands (Northern, Southern, and Western), the Participation Zone/40 nm Arc, the 20 nm Arc, and the Precautionary Zone. As also stated by the Ports, the Participation Zone, for the purposes of both the Vessel Speed Reduction program and the Low Sulfur Main Engine Fuel Incentive Program is defined as the region from berth at the Port of Los Angeles or Port of Long Beach to the arc of a circle with radius 40 nm and centered at Point Fermin Light. (Source: Port of Los Angeles & Port of Long Beach 2008)

The Ports’ two VSR programs target a 12 knot speed for all ship traffic in- and outbound from the Ports, within radial zones of 20 and 40 nm from Point Fermin (Figure 17), because “reduction in speed demands less power on the main engine, which in turn reduces NO<sub>x</sub> emission and fuel usage” (Port of Los Angeles & Port of Long Beach 2006). More specifically, “NO<sub>x</sub> emissions are directly correlated to the engine load and, generally speaking, load and NO<sub>x</sub> emissions decrease as engine load/vessel speed decreases” (Port of Los Angeles & Port of Long Beach 2006). Speed reductions are projected to reduce emissions of other important pollutants as well; according to the Ports, vessel speed reductions could also yield “a potentially significant reduction in DPM [diesel particulate matter, also known as soot] and SO<sub>x</sub> emissions” (Port of Los Angeles & Port of Long Beach 2006).

The policies and mechanisms used by the Ports to successfully effect this broad-scale change in mariner behavior are the focus of this case study. They are reviewed below, and then discussed with respect to their potential for reducing vessel speed, and thereby the risk of ship strike within the Santa Barbara Channel.

Expansion or replication of the Ports' VSR programs to the extent that they could be applied to vessel traffic in the Santa Barbara Channel could be challenging in the short term, with respect to logistical, financial and jurisdictional factors that are identified in the concluding discussion.

Nevertheless, parties with a stake in reducing air pollution from ships, and those with an interest in reducing the risk of collisions with whales in the Santa Barbara Channel, share the common objective of reduced vessel traffic speeds. Therefore, the programmatic "infrastructure" and demonstrated success of the Ports' efforts should be perceived as opportunities for CINMS. The Southern California region's imperative to both reduce air pollution and ship strikes of protected and vulnerable whale populations thus warrants additional exploration of if and how this synergy could be leveraged to implement a VSR program for the Santa Barbara Channel.

## **Management Actions**

### ***1. San Pedro Bay Ports Voluntary VSR program***

The original voluntary VSR program was initiated collectively by the Ports in 2001, for both inbound and outbound vessels to slow to a 12 knot speed within a 20 nm radial zone from Point Fermin, because "ships traveling at slower speeds reduce emissions" (Port of Long Beach 2009a). The 12 knot goal was established because that speed already represented a regulatory limit within the Ports' Precautionary Zone (Figure 17) and thus facilitated continuity of operations (Richard McKenna, Southern California Marine Exchange, pers. comm.). In addition, vessel operators were granted the ability to appeal for a finding of most efficient speed. If an operator could demonstrate that a higher speed would produce fewer emissions, they could be considered in compliance by transiting at that speed (only one shipping company has ever completed this appeal) (Richard McKenna, Southern California Marine Exchange, pers. comm.).

Program establishment was formalized in a Memorandum of Understanding (MOU) developed and signed by representatives of the Ports, EPA, CARB, South Coast AQMD, the Steamship Association of Southern California and the Pacific Merchant Shipping Association (Port of Los Angeles 2008). The Marine Exchange of Southern California, described below, was also a signatory and active participant in development of the MOU and its key programmatic parameters (Richard McKenna, Southern California Marine Exchange, pers. comm.). The agreement on its own did not appear to immediately produce significant results, but instead represented a critical starting point for the signatories to execute various strategies to achieve the MOU's goals.

In 2005 the Port of Long Beach (POLB) deployed its "Green Flag" incentive program targeting 2007 for 100 percent "compliance" with the voluntary VSR within the 20 nm zone (Port of Long Beach 2009b). Specifically, the POLB "committed as much as \$2.2 million a year to encourage participation in the voluntary [VSR] Program" (Port of Long Beach 2009a). Ships that achieve an annual compliance of 90 percent or better with the VSR for all transits in and out of POLB over a 12 month period are eligible for at least a 15 percent reduction in dockage fees "otherwise payable to the Port in the following year" (Port of Long Beach 2009a). Vessels that achieve 100 percent compliance for a 12 month period are presented with a publicized "Green Flag" achievement award (Port of Long Beach 2009b).



Naturally, vessel speed monitoring and data gathering for every ship entering or leaving the 20 nm zone represents a crucial component of both the voluntary VSR and the Green Flag incentive program. This duty is carried out independently by the Marine Exchange of Southern California (Marine Exchange), a non-profit organization “dedicated to the development and efficient flow of maritime commerce throughout the region” (Marine Exchange of Southern California 2009). The Marine Exchange facility in San Pedro, at the city’s topographical apogee, hosts an array of technological assets and advanced instrumentation to conduct comprehensive vessel traffic observations and monitoring, and its data is relied upon by the Ports and other Southern California shipping stakeholders.

While the goal of 100 percent compliance could be considered aggressive, POLB’s Green Flag incentive system has achieved remarkable results for the voluntary VSR program. POLB provides an overview of their key statistics:

*The original Green Flag program, which debuted in 2005, asked ships to slow down within 20 nm of San Pedro’s Point Fermin. Participation in the program has climbed steadily from 60 percent in 2006 to 93 percent in 2008.*

*In 2007, the 20 nm Green Flag program eliminated an estimated 678 tons of nitrogen oxides, 453 tons of sulfur oxides and 60 tons of diesel particulate matter. In addition, the program reduced greenhouse gases by more than 24,000 metric tons of carbon dioxide equivalents (Port of Long Beach 2009b).*

The Port of Los Angeles (POLA) initiated its own Green Flag program in 2005, though in contrast to POLB did not establish a dockage fee incentive program to accompany achievement awards that are presented to participating vessels and shipping lines (Lori Kelman, Port of Los Angeles, pers. comm.). Nonetheless, POLA reports a measure of success of its own, including “486 vessels that were 100-percent compliant in the program” in 2008 (Port of Los Angeles 2009a) (in the context of 2,370 vessel arrivals for the 2008 calendar year, indicating participation of approximately 20.5 percent) (Port of Los Angeles 2009b).

Finally, it should be noted that both Ports revised their process for assigning work crews to unload arrived vessels to further support compliance with the voluntary VSR program. According to the CAAP, the steadily rising rate of compliance “can be at least partially credited to the practice of assignment of gangs [for vessels when they arrive] at the 20-mile boundary, reducing the incentive for ships to move quickly through the speed reduction zone” (Port of Los Angeles and Port of Long Beach 2006).

## **2. Clean Air Action Plan**

The [\*Clean Air Action Plan Technical Report\*](#) finalized in 2006, details a broad array of objectives for reducing air pollution for activities associated with the San Pedro Bay Ports, and measures to achieve those objectives. One such measure is a vessel speed reduction plan that builds on the existing efforts, organization and infrastructure of the voluntary VSR program outlined above. The official title of the CAAP program is “Control Measure Number SPBP-OGV1: Ocean Going Vessel (OGV) Vessel Speed Reduction (VSR)” (Port of Los Angeles and Port of Long Beach 2006).

Like the voluntary VSR program, the CAAP VSR program primarily targets the reduction of NOx emissions. However, it surpasses the original voluntary VSR program in a few key areas. First, the CAAP VSR increases the zone for vessel slowing to 12 knots from 20 nm from Point Fermin, to 40 nm (see Figure 17). According to the CAAP:

*The objective of the VSR program is to reduce NOx emissions from OGVs by slowing their speeds as they approach or depart the Port. NOx emissions are directly correlated to the engine load and, generally speaking, load and NOx emissions decrease as engine load/vessel speed decreases. A voluntary VSR program currently exists under which vessels slow to 12 knots when they are within 20 nm of Point Fermin. This measure establishes a wider VSR zone with an over-water boundary of 40 nm from Point Fermin [emphasis added] (Port of Los Angeles & Port of Long Beach 2006).*

Highlighting the potential benefits of this program, POLB states “if all vessels participate at the 40-nm range, the amount of emissions reduced is projected to more than double. Vessels made nearly 5,000 trips into and out of [POLB] in 2008” (Port of Long Beach 2009b).

On one hand, the Ports appear to be working to fulfill this objective simply through the “scaling up” of their existing Green Flag voluntary programs, for example through the updating of work gang assignments to vessel arrival at the 40 nm line, and by expanding the monitoring capacity of the US Coast Guard and Marine Exchange (Port of Los Angeles & Port of Long Beach 2006). As another example, in January of 2009, POLB began offering even greater dockage fee discounts for (entering and departing) ships that travel at 12 knots within the 40 nm zone “for complying with the 20-nm program, vessel operators receive a 15 percent reduction in dockage fees, known as the “Green Rate.” For slowing down from 40 nm, the vessels receive the “Green-Plus Rate,” which is 25 percent off” (Port of Long Beach 2009b). During the first month of the program, POLB reported a 63 percent compliance rate through the 40 nm zone, while “the existing 20 nm program is holding steady at 93 percent participation” (Port of Long Beach 2009b).

On the other hand, however, the CAAP VSR measure also appears to create the option for new and more rigid controls for vessel traffic speeds within the 40 nm zone should the voluntary and incentive programs prove inadequate. According to the CAAP:

*Since its establishment in 2001, the compliance rate of the [voluntary] VSR program has steadily increased... Parallel to this voluntary strategy, lease requirements will be established and include compliance rates with the VSR program. The Ports will also evaluate the potential of incorporating a requirement to participate in the VSR program as part of the tariff. Both the lease requirements and tariff strategies would be enforceable measures (Port of Los Angeles & Port of Long Beach 2006).*

*...As new leases are negotiated or existing leases come up for renewal, compliance with the VSR program will be a stated condition during negotiations (Port of Los Angeles & Port of Long Beach 2006).*

Further specifying this dual (incentive/mandate) approach, the CAAP identifies the following as one of seven “key elements” for its VSR control measure: “Assure compliance with the VSR program through tariff reduction incentives and included in lease requirements for renewed lease agreements as well as encouraging the continued/increased voluntary participation of those whose leases are not up for review” (Port of Los Angeles & Port of Long Beach 2006).

Reports indicate that the Ports have begun to employ this approach. According the POLA staff, the VSR parameters were recently included in a finalized “homeport” lease agreement with one passenger cruise line that begins in 2011, and similar negotiations are currently under way for “new permits with 3 cargo terminals and a[n additional] cruise line that will include the VSR language” (Lori Kelman, Port of Los Angeles, pers. comm.).

## **Analysis: Potential Application to the Santa Barbara Channel Region**

### ***1. Incentives Work.***

Perhaps the foremost lesson to be gleaned from the Ports’ VSR efforts is that incentives can effectively alter vessel traffic dynamics. This is demonstrated by the exemplary compliance rate of ships landing at POLB, where they earn graduated dockage discounts for compliance at the 20 and 40 nm distances from Point Fermin.

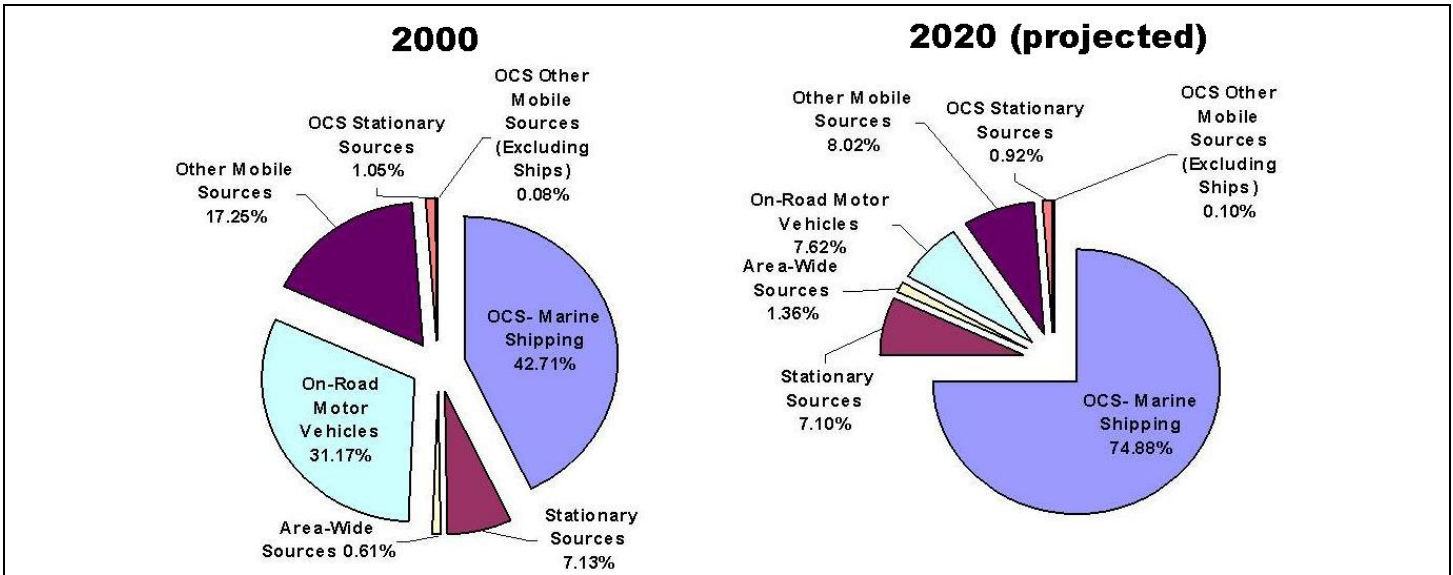
Simultaneously, the reorganization of work gang assignments for the unloading ships, from arrival at the Ports to their arrival at the 20 nm zone limit appears to represent another crucial component of the incentive structure and overall compliance rate, by eliminating a time incentive for non-VSR-participating ships to “speed past” complying ships. The importance of this component is underscored by the high compliance rate in the voluntary VSR program by ships landing at POLA, where no dockage discounts are provided from compliance, but where participation in the voluntary VSR is significant and growing. This point is also reinforced by its contrast with the utter failure of the voluntary speed reduction for the Santa Barbara Channel requested by NOAA and the US Coast Guard in 2007 during the blue whale unusual mortality event (McKenna 2007); one could reasonably infer that, in the absence of a monetary incentive for ships to slow down through the Channel, their primary incentive was to reach the Point Fermin 20 nm “finish line” for work gang assignment in the shortest time possible, and that adherence to the NOAA/US Coast Guard request was dismissed.

Given the complex jurisdictional and regulatory frameworks involved, devising a new incentive system for ships in the Santa Barbara Channel would be a challenging undertaking, involving multi-agency coordination, and the establishment of a source of funds for program administration, and potentially for monetary incentives (in the manner of POLB).

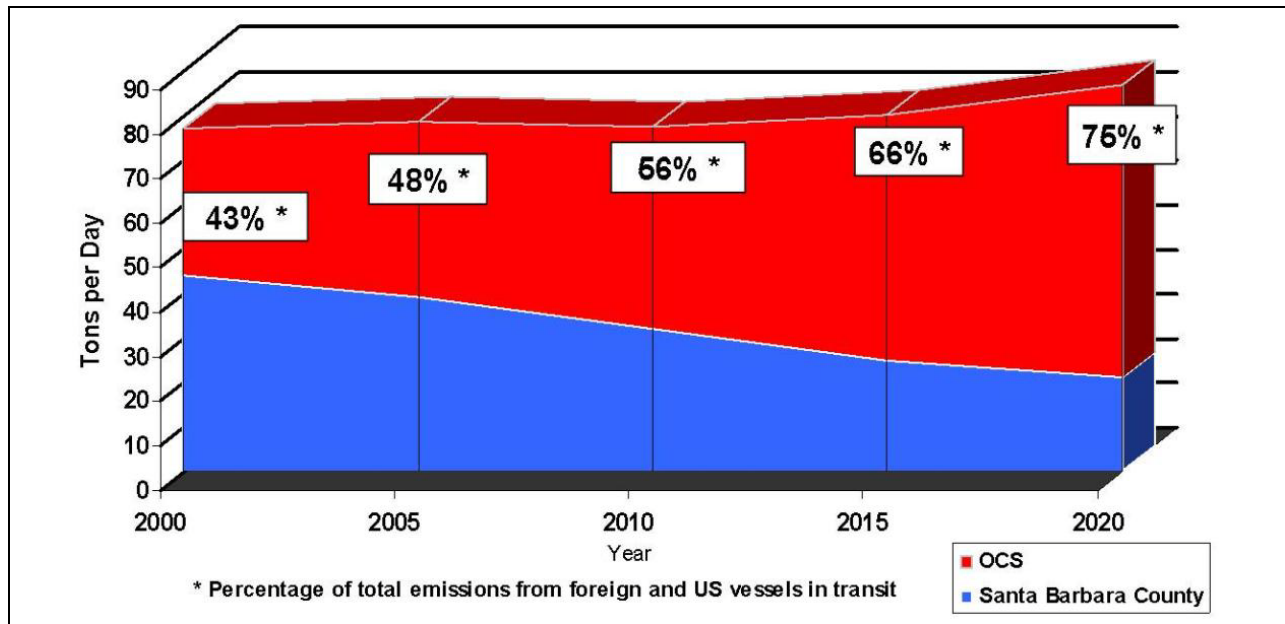
Nonetheless, the remarkable effectiveness of the Ports’ voluntary VSR, as well as the precedent they set in multi-agency collaboration, suggest that focused investigation of possibilities and options for the Santa Barbara Channel would be worthwhile for CINMS and other ship strike stakeholders.

Furthermore, air pollution challenges within the Santa Barbara Channel region suggest that Ventura and Santa Barbara County Air Pollution Control Districts (APCD) may be willing

partners in a project that shows promise in reducing ship emissions. For example, the Santa Barbara County APCD projects significant, ongoing increases in the quantity of pollutants emitted into their area of jurisdiction by ocean going vessels as a proportion of total emissions for the County, potentially increasing the number of days the County exceeds California state ozone thresholds (Figures 18, 19). Accordingly, the agency has formally expressed a willingness to litigate in order to control this output (Dressler 2008).



**Figure 18.** NOx emissions sources in Santa Barbara County for 2000 (left), and projected for 2020 (right). Note Outer Continental Shelf marine shipping activity (i.e. ocean going vessel transits of the Santa Barbara Channel) in purple. (Source: Dressler 2008)



**Figure 19.** Santa Barbara County APCD forecast for total NOx emissions, delineated by mainland versus offshore sources. (Source: Dressler 2008)

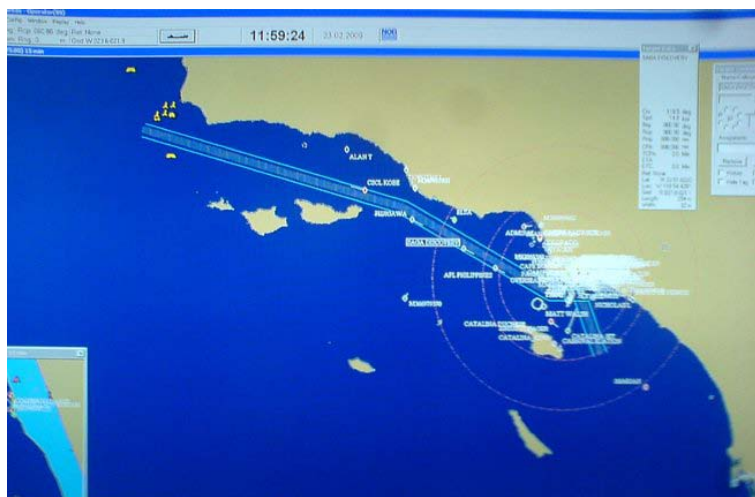
**2. A transition from incentives to a mandate-based framework locks in positive change.**

The CAAP conveys that dependence on voluntary compliance on vessel speed reduction from industry will not deliver adequate reductions in emissions. The strategy of the Ports and other regional air quality stakeholders appears to be to solidify the behavioral changes brought about by the incentive programs through application of additional, more rigid controls over time, such as contract negotiations for shipping lines and, potentially, the imposition of tariffs. Additionally, such a transition could be an important step in reducing the costs associated with maintaining the POLB Green Flag incentive program and other VSR efforts currently funded by the Ports themselves.

Essentially, it appears that the lesson to glean is that the transition to a mandate-based framework may ultimately be required to ensure comprehensive compliance. If an incentive-based VSR program was implemented or extended to the Santa Barbara Channel region, some form of enforceable mandate should be included in the timeline of program implementation.

### ***3. Comprehensive monitoring is vital.***

It appears that the Marine Exchange of Southern California, in its role as data gatherer and processor for the intertwined voluntary and CAAP VSR programs, is a fundamentally important player in achieving the gains that have been made. Meaningful incentives have probably been the key driver of the positive change achieved at the Ports and proper provision of those incentives is driven by the vessel monitoring and data handled by the Marine Exchange.



**Figure 20.** Snapshot of one of several vessel tracking displays at the Marine Exchange of Southern California. (Source: Marine Exchange of Southern California)

As noted above, the Marine Exchange carries out this task with an array of complex instrumentation, which has been systematically upgraded since 2006 to handle monitoring to the 40 nm range established in the CAAP (Figure 20).

Adequate, trustworthy monitoring (i.e. the timely processing of vessel speed observations) probably represents a significant logistical challenge for systematic vessel speed reduction in the Santa Barbara Channel, and therefore another important focal point for future research. CINMS, the Marine

Exchange, NMFS, and other shipping stakeholders should explore options and needs for expansion or replication of the Marine Exchange's monitoring capabilities to the Santa Barbara Channel region, so that future vessel reduction efforts in the sanctuary-region are empowered with adequate data to provide incentives and enforce mandates.

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## Appendix A: “How Does Slowing a Ship Down Reduce Emissions?”

Excerpted from: *San Pedro Bay Ports Clean Air Action Plan: Vessel Speed Reduction*  
Available at <http://www.cleanairactionplan.org/strategies/vessels/vsr.asp>

For main engines, the energy required for vessel propulsion varies with the vessel speed; the faster the speed, the greater the energy requirements to maintain that speed. In fact, the power needed to move a ship varies with the cube of its speed. For example, for a ship with a 70,000 kilowatt (kW) main engine that powers the ship to 25 knots, reducing the ship’s speed to 20 knots requires only 36,000 kW (about half); slowing further to 12 knots reduces the power demand even more to about 8,000 kW (just over a tenth).

Conversely, as speed is decreased, energy requirements are also significantly reduced. Since the energy required to operate a ship’s main engine is directly related to emissions, actions that reduce energy consumption typically reduce emissions from these main engines.

Two questions are often raised about the emissions benefits of vessel speed reduction. The first is that main engines are somewhat less efficient at slower speeds. It is important to note that this reduced efficiency is more than offset by the benefits of reduced energy consumption (and therefore associated emissions reduction) that result from slower transit speeds. The second is that reducing ship speed means that the ship takes longer to move from point A to point B, and therefore spends more time transiting. Auxiliary engines do operate during transit, and therefore the auxiliary engines are operating for a longer period of time over the same distance, when the vessel is moving more slowly. It is true that the additional auxiliary engine operation for longer transit times will increase auxiliary engine energy consumption. However, the emission reduction benefits resulting from decreased main engine energy consumption significantly outweigh the increased emissions from increased auxiliary engine operation at slower speeds. This reduction in main engine energy consumption provides for reduced emissions overall of NO<sub>x</sub>, particulate matter (PM), and sulfur oxides (SO<sub>x</sub>). In addition, reduction in fossil fuel consumption results in a reduction of greenhouse gas emissions.”

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