Vessel Transits Through Olympic Coast National Marine Sanctuary and Area to Be Avoided (ATBA) - 2017 Estimated Compliance

Introduction

Designated in 1994, Olympic Coast National Marine Sanctuary (OCNMS or sanctuary) is a place of regional, national, and global significance. The sanctuary, which is connected to both the Big Eddy Ecosystem and the California Current Large Marine Ecosystem, is the site of one of North America's most productive marine regions and spectacular, undeveloped shorelines. Potential release of oil or other hazardous material from a major marine accident is regarded as the most serious threat to resources within and qualities of the sanctuary. Prevention of spills is therefore one of OCNMS's highest priorities. As a steward of these vitally important natural resources, OCNMS will continue to collaborate with other governments, agencies, and user groups to reduce the potential for oil spills and improve contingency planning for spill response. OCNMS's major oil spill prevention initiative is an International Maritime Organization (IMO) designated Area to be Avoided (ATBA). This report is the sanctuary's annual reporting of estimated ATBA compliance rates. Data from Automatic Identification System (AIS) transceivers is collected, vessel details are added, and compliance to the ATBA is evaluated. In an effort to improve the efficiency of vessel monitoring, we made three changes in 2017. These changes are described in the Discussion of Data section. Our evaluation of the 2017 vessel transits off the Washington coast shows compliance rates slightly lower than in 2016 (97.3% in 2016 and 95.9% in 2017). While lower in 2017, estimated compliance of the ATBA continues to reflect a high degree of cooperation by the maritime industry. This apparent drop in compliance is discussed in the Data Analysis section.

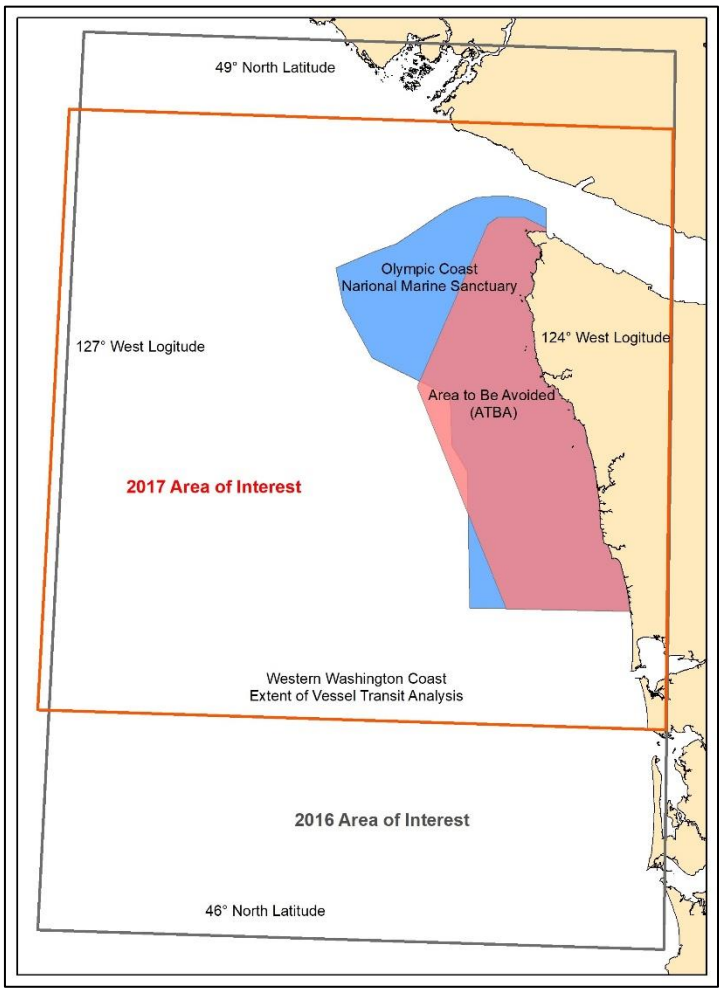

Figure 1: Vessel Transit Analysis Area.

Background

During the sanctuary designation process NOAA worked with the U.S. delegation to the IMO to designate an Area to be Avoided (ATBA) off the coast of Washington to reduce the risk of marine casualties including oil spills, and the resulting environmental damage to Olympic Coast National Marine Sanctuary. For more information on the ATBA see the attached informational flyer (Figure 2 and Figure 3). This flyer is used in outreach efforts to the marine industry, and is also included in the U. S. Coast Guard Sector Puget Sound Vessel Traffic Service's (VTS) User's Manual. In addition, ATBA

boundaries and provisions are included in official navigational products, such as nautical charts and Coast Pilot 7.

ATBA Provisions

All ships and barges that carry oil or hazardous materials as cargo, and all ships 400 gross tons and above, solely in transit, are advised to transit outside of this ATBA. OCNMS, in cooperation with the U.S. and Canadian coast guards, monitors vessel compliance under this voluntary program. While the ATBA does not apply to government vessels, the sanctuary, in partnership with the U.S. and Canadian coast guards, seeks to ensure that government vessels comply when in transit. This includes NOAA, U.S. and Canadian Coast Guard vessels, and the U.S. Navy.

It is important to understand the implications of the ATBA provision "solely in transit." The ATBA was not intended to preclude lawful operations of vessels within the ATBA. Examples include fishing, search and rescue, and research vessels that may conduct operations off Washington's outer coast. When these vessels are moving through the area enroute to working grounds beyond the ATBA, or solely in transit, we request their compliance with the ATBA.

While we recognize that there are vessels over 400 gross tons that are legitimately conducting operations in the ATBA, we do not attempt to adjust the estimated compliance numbers to account for this. For that reason some vessel types, such as fishing and research vessels, will likely show an artificially lower compliance rate because all their occurrences in the ATBA are counted as non-compliance. The reason for this approach is the difficulty of determining the nature of some transits. In some cases, it is fairly obvious from the nature of the track line that a research or fishing vessel is conducting operations, in other cases it is not as obvious. Due to this difficulty and in order to be consistent from one year to the next, OCNMS does not make adjustments to the compliance estimates for individual vessel transits based on perceived operations.

ATBA Compliance Reporting

From 2004 through 2011, Ecology published estimated ATBA compliance rates as part of their annual VEAT publication. VEAT is offered by Ecology in response to public requests for information about commercial vessel traffic in Washington waters. There is considerable overlap between the VEAT report and OCNMS's vessel monitoring efforts and the reason why the two reports were for a time coordinated. When OCNMS made significant changes to their monitoring methods, additional documentation was needed. This led to the need, starting in 2012, for an independent OCNMS report. Both the VEAT (2004-2011) and OCNMS (2012-2017) reports can be downloaded at http://olympiccoast.noaa.gov/protect/incidentresponse/vesseltraffic.html. VEAT reports following 2011 can be downloaded at Ecology's publication page, https://fortress.wa.gov/ecy/publications/.

Discussion of Data

In 2017, in response to a loss of OCNMS technical capacity and the need to make our vessel traffic monitoring more sustainable, a number of changes were instituted. These three changes were: the source of Automatic Identification System (AIS) data, the source of third party vessel attributes, and the area analyzed. The first two changes were made to become more consistent with the NOAA Fisheries Office of Protected Resources (OPR), which has well-established AIS processing techniques currently in use for a variety of conservation applications involving vessel traffic. By collaborating with OPR, OCNMS is able to maintain vessel monitoring at a reduced staffing level.

The sanctuary continues to conduct compliance analysis using satellite AIS (S-AIS); however, data that was once provided directly from a commercial satellite company is now being provided thorugh OPR. This alternative allowed the sanctuary to adopt OPR AIS processing techniques to their specific management need to monitor ATBA compliance.

The AIS system is primarily a collision avoidance system and does not have all the information needed for monitoring vessel traffic and estimating ATBA compliance in the sanctuary, e.g., descriptive vessel types and gross tonnage. This information was originally obtained from Canadian Coast Guard Vessel Traffic Operators, and added to digitized radar data. When vessel monitoring changed from Canadian vessel radar to S-AIS data between 2011 and 2012, methods of attributing vessel type changed. OCNMS began using a lookup table to provide additional vessel details. This table was based on information originally obtained by from the U.S. Coast Guard's Puget Sound Vessel Traffic Service. This data needed to be updated on a regular basis by the sanctuary. This resulted in some changes to vessel types in 2012. Additional minor modifications were made in 2014. Changes to vessel type are captured in annual reports and summarized in Table 1. Care should be taken in comparing results between years.

Starting in 2017, OCNMS began using the information source also utilized by OPR. Gross tonnage, vessel type, and other vessel information is now obtained from the IHS Maritime World Register of Ships (IHS). Relevant IHS vessel attributes are joined to the AIS transit data using the vessel's Maritime Mobile Service Identity (MMSI) number as a common key. The 320 different possible vessel types found in the IHS dataset were aggregated into vessel type classes consistent with previous vessel type descriptions. To simplify analysis and visual display of data similar vessel types are grouped into one of six more general vessel classes; see Table 1, Vessel Classes column.

The adaptation of the IHS data to the OCNMS AIS data reduced, but did not eliminate, the need for a custom vessel lookup table. There were two primary areas that necessitated additional research on vessels. The first is related to the IHS vessel types. Some of the 320 vessel types are obscure, e.g., Radio Station Vessel, and not likely to be seen in the waters of OCNMS and not easily aggregated into more general types. In such cases, these vessels would be researched and manually changed if appropriate. Fortunately, this was not common. In the second and more common example, the vessel identified in the AIS is not in the IHS database. This was most common for smaller private and fishing vessels under 400 GT. There were a total of 760 vessels that were further researched and updated. Of the 760 researched, only 52 were over 400 GT and part of the ATBA compliance analysis.

For the analysis of S-AIS data between 2012 and 2016, we reviewed transits from 46° to 49° North Latitude and from 124° to 127° West Longitude. This 29,099 square mile area covered the entire outer coast of Washington state (see Figure 1) and was selected to support the marine spatial planning efforts of the state of Washington, see http://www.msp.wa.gov/. In an effort to improve the sustainability of our monitoring effort, a smaller 19,692 square mile area was selected for 2017. The new area is from approximately 46°45' N to 48° 45' N and maintains the same east and west boundaries (see Figure 1). This change reduces the number of vessels that needed to be researched. Some of the vessel transit data excluded from the 2017 dataset includes large commercial vessel traffic enroute to or departing from the Columbia River and smaller vessel traffic enroute to or departing from the smaller ports on the west coast of Vancouver Island. While of interest to some regional managers, this information is not needed by sanctuary managers and was eliminated to reduce workload.

Table 1: Changes to Vessel Types from 2011-2017

2011 Vessel Types	2012-2013 Vessel Types	2014-2017[1] Vessel Types	Vessel Classes
Bulk Carrier	Bulk Carrier	Bulk Carrier	CARGO
Ore-Bulk-Oil Vessel (OBO)	Bulk Carrier	Bulk Carrier	CARGO
Cable Layer	Cable Layer	Cable Layer	MISC
General Cargo Ship	Cargo Ship	Cargo Ship	CARGO
Heavy Load Carrier	Cargo Ship	Cargo Ship	CARGO
Non-oil Tanker	Chemical Carrier	Chemical Carrier	CARGO
Chemical Tanker	Chemical Carrier	Chemical Carrier	TANKER
Container Ship	Container Ship	Container Ship	CARGO
	Dredger	Dredger	MISC
	Drill Ship	Drill Ship	MISC
Fishing Vessel	Fishing Vessel	Fishing Vessel	FISHING
(LPG) and (LNG) Carrier[2]	Liquefied Gas Carrier	Liquefied Gas Carrier	TANKER
Oil Tanker	Oil Tanker	Oil Tanker	TANKER
Cruise Ship	Passenger Ship	Passenger Ship	PASSENGER
	Pollution Control	Pollution Control	MISC
	Private Vessel	Private Vessel	MISC
	Public Vessels[3]	Public Vessels	MISC
Refrigerated Ship	Refrigerated Cargo	Refrigerated Cargo	CARGO
	Research Ship	Research Ship	MISC
Roll-on Roll-off Vessel (RoRo)	RoRo Cargo Ship	RoRo Cargo Ship	CARGO
	Supply Ship	Supply Ship	MISC
Tug[4]	Tug	Tug	TUG
Articulated Tank Barge (ATB)	Tug	Articulated Tug Barge [5]	TUG
Tugs with Chemical Barge	Tug	Tug	TUG
Tugs with Oil Barge	Tug	Tug	TUG
Vehicle Carrier	Vehicle Carrier	Vehicle Carrier	CARGO

The results of the data processing of the S-AIS data, the addition of additional attributes, and an analysis by area, e.g., OCNMS and ATBA, results in an estimated compliance table, by vessel type (see Table 2). The overall estimated compliance for the OCNMS ATBA in 2017 is 95.9%. These results are further discussed in the following section.

[1] Due to changes in data sources and methods, some vessels had their type changed in 2017. Care should be taken in comparing results from 2017 and later years to data from the 2014-2016 period.
[2] Liquefied Petroleum Gas (LPG) and Liquefied Natural Gas (LNG) are types of Liquefied Gas Carriers.
[3] The ATBA does not apply to public vessels and they are not included in the estimated compliance table. OCNMS collects this information and it may be used for different types of analysis.
[4] Only tugs that were transiting with cargoes of petroleum or hazardous materials were tracked prior to 2012.
[5] From 2012-2013, Articulated Tug Barge (ATB) vessels were included in the vessel type Tug; starting in 2014, ATB vessels were broken out into their own category.

Table 2: Estimated ATBA Compliance Rates for 2017 (vessels > 400 GT)

Vessel Type	Area of Interest[6]	Transits passing through the Sanctuary[7]	Transits passing through the ATBA within the Sanctuary[8]	Estimated ATBA Compliance Rate[9]
	1	2	3	4
Articulated Tug Barge	291	253	1	99.6%
Bulk Carrier	3595	1904	27	98.6%
Cable Layer	19	8	0	100.0%
Cargo Ship	539	333	8	97.6%
Chemical Carrier	715	515	4	99.2%
Container Ship	2160	1171	3	99.7%
Dredger	38	0	0	
Fishing Vessel	620	257	118	54.1%
Liquefied Gas Carrier	42	25	0	100.0%
Oil Tanker	435	277	3	98.9%
Passenger Ship	472	170	2	98.8%
Pollution Control	3	0	0	
Private Vessel	52	38	14	63.2%
Refrigerated Cargo	33	21	0	100.0%
Research Ship	88	56	19	66.1%
RoRo Cargo Ship	209	106	2	98.1%
Supply Ship	34	21	8	61.9%
Tug	776	275	25	90.9%
Vehicle Carriers	786	517	8	98.5%
TOTAL	10907	5947	242	95.9%

Data Analysis

Due to changes in data source and processing, the results from 2017 were compared to 2016 as a quality check. The first difference that was noted was the decrease in estimated compliance, from 97.3% in 2016 to 95.9% in 2017, a decrease of 1.4%. Another difference was noted when looking at vessels, by type, that transited through the sanctuary. While the total number of vessels, greater than 400 GT, within the sanctuary was nearly unchanged from 2016 to 2017, there was poor agreement in several vessel type categories. The percent change, by vessel type from 2016 to 2017, varied from a 1% increase by container ships to a 360% increase in Chemical Carrier. The cause of these significant changes are believed to be due to the non-standard nature of vessel types, and the fact that OCNMS changed their methodology for

[6] The vessel transits in Column 1 are from S-AIS data and include commercial vessels greater than 400 gross tons. This is a smaller geographic area than was reported 2012 - 2016.
[7] Column 2 includes a subset of the S-AIS vessel transits through the sanctuary.
[8] Column 3 includes a subset of the sanctuary vessel transits that had at least one AIS record within the ATBA. These are vessels potentially not complying with the provisions of the ATBA.
[9] Column 4 shows the percentage of vessels transiting through the sanctuary that stayed out of the ATBA. {Column 4 = 1 – (Column3/Column2)}. This is used as an estimate of compliance with ATBA provisions.

assigning vessel types in 2017. It is believed that our new methodology of using data from the IHS Maritime World Register of Ships will provide a more consistent basis for future comparisons of OCNMS transits by vessel type. However, this will make comparisons to earlier years difficult. Based on the lack of consistency of transits by vessel type, two alternate methods of comparing data were explored. The first, a comparison of vessel type transits, by year (see Table 3). The second, a comparison of compliance in 2016 to 2017, by gross tonnage (see Table 6 and Table 7).

Table 3: OCNMS transits, by vessel type.

Vessel Type	2016 OCNMS Transits	2017 OCNMS Transits	Change
Articulated Tug Barge	314	253	-19%
Bulk Carrier	1985	1904	-4%
Cable Layer	9	8	-11%
Cargo Ship	317	333	5%
Chemical Carrier	112	515	360%
Container Ship	1165	1171	1%
Fishing Vessel	174	257	48%
Liquefied Gas Carrier	21	25	19%
Oil Tanker	621	277	-55%
Passenger Ship	252	170	-33%
Private Vessel	20	38	90%
Refrigerated Cargo	12	21	75%
Research Ship	27	56	107%
RoRo Cargo Ship	162	106	-35%
Supply Ship	8	21	163%
Tug	185	275	49%
Vehicle Carriers	443	517	17%
TOTAL	5946	5947	2%

To better understand the changes in vessel type numbers, the data in 2016 was compared to 2017. First, we identified which vessels (defined by their MMSI number) were in both data sets. A total of 933 vessels, representing 2,681 of the transits from 2016 (45%) and 3,029 transits from 2017 (51%), were identified as being in both datasets. Of these we looked to see how many had the same vessel type for both years, and if they did change from 2016 to 2017, how. Of the 933 vessels, 829 (89%) had the same vessel type. How the remaining 104 vessels changed from 2016 to 2017 was reviewed to look for flaws in data processing routines. Table 4 shows the top four categories of vessels that were present in both 2016 and 2017, but had different vessel types in each year.

Table 4: Examples of how some vessels were assigned different vessel types based on processing changes, between 2016 and 2017.

2016 OCNMS Vessel Types	2011 OCNMS Vessel Types	Vessel Count
Oil Tanker	Chemical Carrier	19
Bulk Carrier	Cargo Ship	16
Cargo Ship	Bulk Carrier	16
RoRo Cargo Ship	Vehicle Carriers	14

The following descriptions are for the IHS vessel type, (in parenthesis) that are closest to the OCNMS vessel types represented in Table 4.

Oil Tanker (Crude/Oil Products Tanker) - A tanker for the bulk carriage of crude oil but also for carriage of refined oil products.

Chemical Carrier (Chemical Tanker) - A tanker for the bulk carriage of chemical cargoes, lube oils, vegetable/animal oils, and other chemicals as defined in the International Bulk Chemical Code. Tanks are coated with suitable materials, which are inert to the cargo.

Bulk Carrier (Bulk Carrier) - A single deck cargo vessel with an arrangement of topside ballast tanks for the carriage of bulk dry cargo of a homogeneous nature.

Cargo Ship (General Cargo Ship) - A single or multi deck cargo vessel for the carriage of various types of dry cargo. Single deck vessels will typically have box shaped holds. Cargo is loaded and unloaded through weather deck hatches.

RoRo Cargo Ship (Ro-Ro Cargo Ship) - A single or multi deck cargo ship for the carriage of laden vehicles which are loaded via ramps.

Vehicle Carrier (Vehicles Carrier) - A multi deck cargo ship for the carriage of new cars and trucks, which are loaded via ramps.

It is common to find different, yet similar, vessel types used to describe the same vessel. These differences do not reflect any issues with the two separate processes used to describe vessels in this and previous ATBA compliance analysis, but reflect the non-standard nature of vessel types. Table 5, using the more common changes in vessel types reflected in Table 4, compares the number of transits for combinations of similar vessel types from 2016 to 2017.

Table 5: OCNMS transits, by for selected vessel types, summarized by similar type.

Vessel Type	2016 OCNMS Transits	2017 OCNMS Transits	Change
Oil Tanker	621	277	-55%
Chemical Carrier	112	515	360%
Similar Type Subtotal	733	792	8%
Bulk Carrier	1985	1904	-4%
Cargo Ship	317	333	5%
Similar Type Subtotal	2302	2237	-3%
RoRo Cargo Ship	162	106	-35%
Vehicle Carriers	443	517	17%
Similar Type Subtotal	605	623	3%

One of the critical factors in estimating compliance is the vessel's gross tonnage. Gross tonnage is not one of the vessel attributes that is included in the AIS data stream, and it must be added in post processing. Gross tonnage, which is a much more objective vessel characteristic than vessel type, should be less sensitive to vessel data source. Because both the 2016 and 2017 data included gross tonnage, we had an alternative means to compare the years. Table 6 – 2016 and Table 7 – 2107 show good agreement in both numbers and estimated compliance rates, especially for vessels 10,000 GT and larger. Numbers and

compliance for vessels in the 400 – 9,999 GT range show a greater variance, indicating that the reduction in estimated compliance was due to the behavior of smaller vessels. If we only look at vessels greater then 10,000 GT, estimated compliance for 2016 and 2017 is identical at 98.8%.

Table 6: 2016 estimated compliance, by gross tonnage.

Gross Tonnage	Transits passing through the Sanctuary	Transits passing through the ATBA within the Sanctuary	Estimated ATBA Compliance Rate
400 to 9,999 GT	819	94	88.5%
10,000 to 19,999 GT	411	7	98.3%
20,000 to 29,999 GT	1071	15	98.6%
30,000 GT or greater	3525	40	98.9%
TOTAL	5826	156	97.3%

Table 7: 2017 estimated compliance, by gross tonnage.

Gross Tonnage	Transits passing through the Sanctuary	Transits passing through the ATBA within the Sanctuary	Estimated ATBA Compliance Rate
400-9,999 GT	999	184	81.6%
10,000-19,999 GT	358	6	98.3%
20,000-29,999 GT	1077	11	99.0%
30,000 GT and Greater	3513	41	98.8%
TOTAL	5947	242	95.9%

Summary

While lower in 2017, estimated compliance of the ATBA continues to reflect a high degree of cooperation by the maritime industry. Estimates of compliance rates are slightly lower than in 2017 (95.9%) then 2016 (97.3%). We theorize that the lower compliance rate may potentially be explained by an increase in lawful fishing in 2017, but this was not confirmed and is beyond the scope of this report. If we exclude fishing vessels from our calculations, adjusted estimated compliance in 2016 (98.2%) is closer to the estimated compliance in 2017 (97.8%). Additional research into fishing activity with the ATBA is possible with the allocation of additional resources, but is not currently planned. In addition estimated compliance rates from 10,000 and above GT, are identical in both 2016 and 2017 (98.8%).

Vessel monitoring in OCNMS for the 2017 calendar year presented challenges and opportunities. In partnership with NOAA Fisheries Office of Protected Resources, we changed data sources and methods, and analyzed how these changes monitoring results. Analysis shows that the overall results are comparable, but that care will be needed when comparing the 2017 results, by vessel type, to earlier years. Future years should compare well with the 2017 analysis.

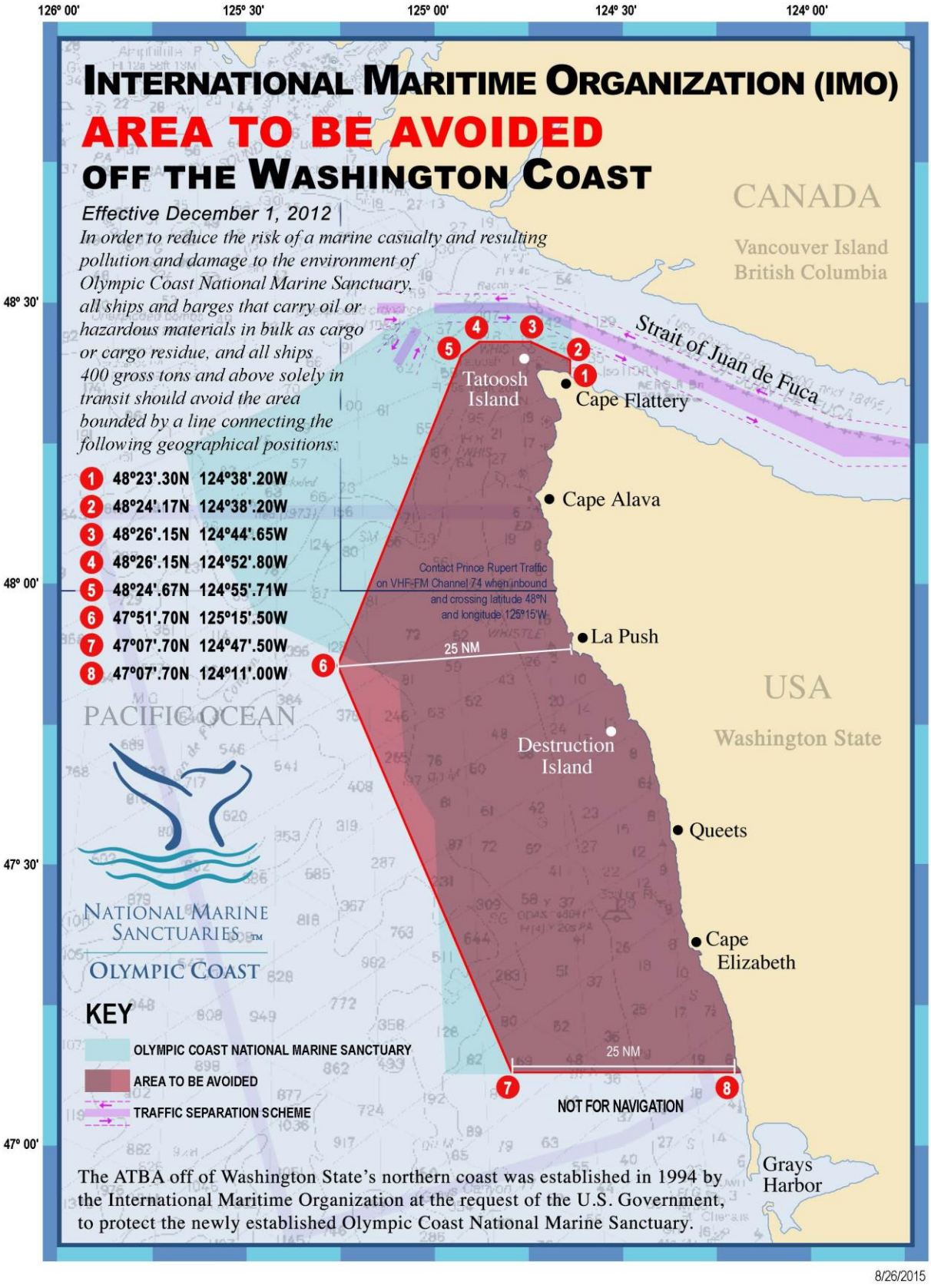

Figure 2: ATBA Information Flyer – Page 1; shows boundary and explains to which vessels it applies.

Why does the IMO establish ATBAs?

- The IMO establishes ATBAs in defined areas where navigation is very hazardous or where it is important to avoid casualties.

Why is it important for vessels to remain offshore and avoid this area?

- Reduces risk of vessel grounding on shore
- Reduces risk of collision with small vessels traveling close to shore
- Allows more time for assistance to arrive to help a disabled vessel
- Increases protection of coastal resources
- In the event of an oil spill:
  - Allows more time for spill cleanup and containment crews to arrive
  - Decreases the chance of spill impacts on the shoreline
  - Increases spill evaporation and degradation time

How were the boundaries of the ATBA chosen?

- The boundaries were chosen to protect sanctuary resources most at risk from vessel casualties.
- The boundaries are compatible with the Traffic Separation Scheme

How was the vessel applicability chosen for the ATBA?

- Vessels greater than 400 gross tons were selected because of the substantial amount of bunker fuel that they carry and the risk that a spill would pose to sanctuary resources
- Vessels that carry oil or hazardous materials in bulk as cargo or cargo residue were selected due to the risk that a spill would pose to sanctuary resources
- The ATBA applies to vessels solely in transit and does not apply to vessels engaged in activities otherwise allowed in the sanctuary, such as fishing and research. The ATBA also does not apply to government vessels, although they are encouraged to avoid the area when solely in transit.

Natural characteristics of Olympic Coast National Marine Sanctuary:

- 128 species of seabirds within the sanctuary
- 29 species of whales, dolphins, and other marine mammals reside or visit the area
- Washington State's only sea otter population
- Many species of fish and shellfish harvested for commercial, subsistence or recreational purposes
- Over 300 species of resident intertidal invertebrates, aquatic plants, and fish
- Diverse habitat types supporting complex food chains, including kelp communities, rocky intertidal zones, sand beaches, and offshore rocks
- Within the usual and accustomed fishing grounds of the Hoh, Makah, Quileute tribes and the Quinault Indian Nation
- Adjacent to Olympic National Park, Washington Islands National Wildlife Refuges, and Washington State Seashore Conservation Area

FOR MORE VESSEL TRAFFIC INFORMATION:

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8/26/2015

Figure 3 ATBA Information Flyer – Page 2; provides rationale for ATBA and information on OCNMS.