Office of National Marine Sanctuaries
Office of Response and Restoration

Screening Level Risk Assessment Package

John Straub

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National Oceanic and
Atmospheric Administration

Office of National Marine Sanctuaries
Daniel J. Basta, Director
Lisa Symons
John Wagner

Office of Response and Restoration
Dave Westerholm, Director
Debbie Payton
Doug Helton

Photo: Photograph of *John Straub*
Source: http://www.photoship.co.uk/JAlbum%20Ships/Old%20Ships%20J/slides/John%20Straub-01.html

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Project Background

The past century of commerce and warfare has left a legacy of thousands of sunken vessels along the U.S. coast. Many of these wrecks pose environmental threats because of the hazardous nature of their cargoes, presence of munitions, or bunker fuel oils left onboard. As these wrecks corrode and decay, they may release oil or hazardous materials. Although a few vessels, such as USS *Arizona* in Hawaii, are well-publicized environmental threats, most wrecks, unless they pose an immediate pollution threat or impede navigation, are left alone and are largely forgotten until they begin to leak.

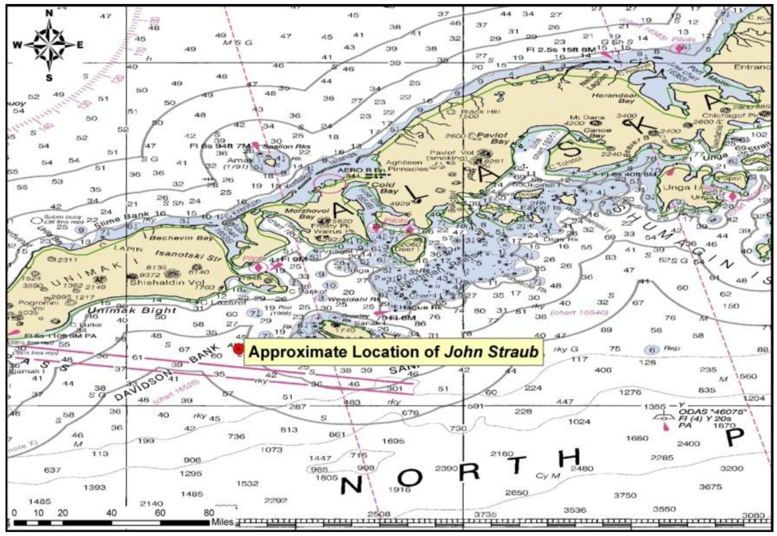
In order to narrow down the potential sites for inclusion into regional and area contingency plans, in 2010, Congress appropriated $1 million to identify the most ecologically and economically significant potentially polluting wrecks in U.S. waters. This project supports the U.S. Coast Guard and the Regional Response Teams as well as NOAA in prioritizing threats to coastal resources while at the same time assessing the historical and cultural significance of these nonrenewable cultural resources.

The potential polluting shipwrecks were identified through searching a broad variety of historical sources. NOAA then worked with Research Planning, Inc., RPS ASA, and Environmental Research Consulting to conduct the modeling forecasts, and the ecological and environmental resources at risk assessments.

Initial evaluations of shipwrecks located within American waters found that approximately 600-1,000 wrecks could pose a substantial pollution threat based on their age, type and size. This includes vessels sunk after 1891 (when vessels began being converted to use oil as fuel), vessels built of steel or other durable material (wooden vessels have likely deteriorated), cargo vessels over 1,000 gross tons (smaller vessels would have limited cargo or bunker capacity), and any tank vessel.

Additional ongoing research has revealed that 87 wrecks pose a potential pollution threat due to the violent nature in which some ships sank and the structural reduction and demolition of those that were navigational hazards. To further screen and prioritize these vessels, risk factors and scores have been applied to elements such as the amount of oil that could be on board and the potential ecological or environmental impact.

Executive Summary: *John Straub*



The freighter *John Straub*, torpedoed and sunk during World War II off the coast of Unimak Island, at the southern end of the Alaska Peninsula in 1944, was identified as a potential pollution threat, thus a screening-level risk assessment was conducted. The different sections of this document summarize what is known about the *John Straub*, the results of environmental impact modeling composed of different release scenarios, the ecological and socio-economic resources that would be at risk in the event of releases, the screening-level risk scoring results and overall risk assessment, and recommendations for assessment, monitoring, or remediation.

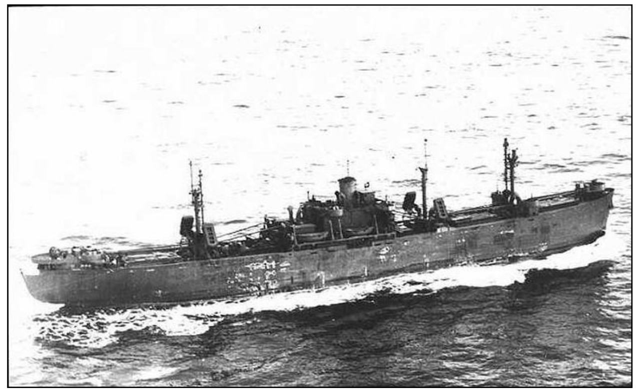
Based on this screening-level assessment, each vessel was assigned a summary score calculated using the seven risk criteria described in this report. For the Worst Case Discharge, *John Straub* scores High with 15 points; for the Most Probable Discharge (10% of the Worse Case volume), *John Straub* scores Medium with 13 points. Given these scores, NOAA would typically recommend that this site be considered for further assessment to determine the vessel condition, amount of oil onboard and feasibility of oil removal action. However, given that the location of this vessel is unknown, NOAA recommends that surveys of opportunity be used to attempt to locate this vessel and that general notations are made in the Area Contingency Plans so that if a mystery spill is reported in the general area, this vessel could be investigated as a source. Outreach efforts with the technical and recreational dive community as well as commercial and recreational fishermen who frequent the area would be helpful to gain awareness of localized spills in the general area where the vessel is believed lost.

Vessel Risk Factors		Risk Score	
Pollution Potential Factors	A1: Oil Volume (total bbl)	Med	
	A2: Oil Type		
	B: Wreck Clearance		
	C1: Burning of the Ship		
	C2: Oil on Water		
	D1: Nature of Casualty		
	D2: Structural Breakup		
Archaeological Assessment	Archaeological Assessment	Not Scored	
Operational Factors	Wreck Orientation	Not Scored	
	Depth		
	Confirmation of Site Condition		
	Other Hazardous Materials		
	Munitions Onboard		
	Gravesite (Civilian/Military)		
	Historical Protection Eligibility		
		WCD	MP (10%)
Ecological Resources	3A: Water Column Resources	Low	Low
	3B: Water Surface Resources	High	High
	3C: Shore Resources	Med	Low
Socio-Economic Resources	4A: Water Column Resources	Low	Low
	4B: Water Surface Resources	High	Med
	4C: Shore Resources	High	High
Summary Risk Scores		15	13

The determination of each risk factor is explained in the document. This summary table is found on page 39.

SECTION 1: VESSEL BACKGROUND INFORMATION: REMEDIATION OF UNDERWATER LEGACY ENVIRONMENTAL THREATS (RULET)

Vessel Particulars



Official Name: *John Straub*

Official Number: 244753

Vessel Type: Freighter

Vessel Class: EC2-S-C1 Type Liberty Ship

Former Names: N/A

Year Built: 1943

Builder: Oregon Shipbuilding Corp. Portland, OR

Builder's Hull Number: 808

Flag: American

Owner at Loss: United States War Shipping Administration

Controlled by: Unknown **Chartered to:** Unknown

Operated by: Alaska SS Company **Homeport:** Portland, OR

Length: 422 feet **Beam:** 57 feet **Depth:** 34 feet

Gross Tonnage: 7,176 **Net Tonnage:** 4,380

Hull Material: Steel **Hull Fastenings:** Welded **Powered by:** Oil-fired steam

Bunker Type: Heavy fuel oil (Bunker C) **Bunker Capacity (bbl):** 12,054

Average Bunker Consumption (bbl) per 24 hours: Unknown

Liquid Cargo Capacity (bbl): Unknown **Dry Cargo Capacity:** 499,573 cubic feet bale space

Tank or Hold Description: EC2-S-C1 Type Liberty Ship design

Casualty Information

Port Departed: Seattle, WA
Destination Port: Attu Shemya

Date Departed: Unknown
Date Lost: April 19, 1944

Number of Days Sailing: Unknown
Cause of Sinking: Act of War (Torpedo or Mine)

Latitude (DD): 54.33333
Longitude (DD): -163.3333

Nautical Miles to Shore: 20
Nautical Miles to NMS: 1,936

Nautical Miles to MPA: 0
Nautical Miles to Fisheries: Unknown

Approximate Water Depth (Ft): 200
Bottom Type: Unknown

Is There a Wreck at This Location? Unknown, the wreck has never been located or surveyed

Wreck Orientation: Unknown, but the wreck broke in half before sinking

Vessel Armament: Yes, but the number and types are unknown

Cargo Carried when Lost: 9,000 tons of Army cargo including explosives

Cargo Oil Carried (bbl): 0
Cargo Oil Type: N/A

Probable Fuel Oil Remaining (bbl): ≤ 12,054
Fuel Type: Heavy fuel oil (Bunker C)

Total Oil Carried (bbl): ≤ 12,054
Dangerous Cargo or Munitions: Yes

Munitions Carried: Munitions for onboard weapons and explosives bound for the Alaskan War Theater

Demolished after Sinking: No
Salvaged: No

Cargo Lost: Yes
Reportedly Leaking: No

Historically Significant: Yes
Gravesite: No

Salvage Owner: Not known if any

Wreck Location

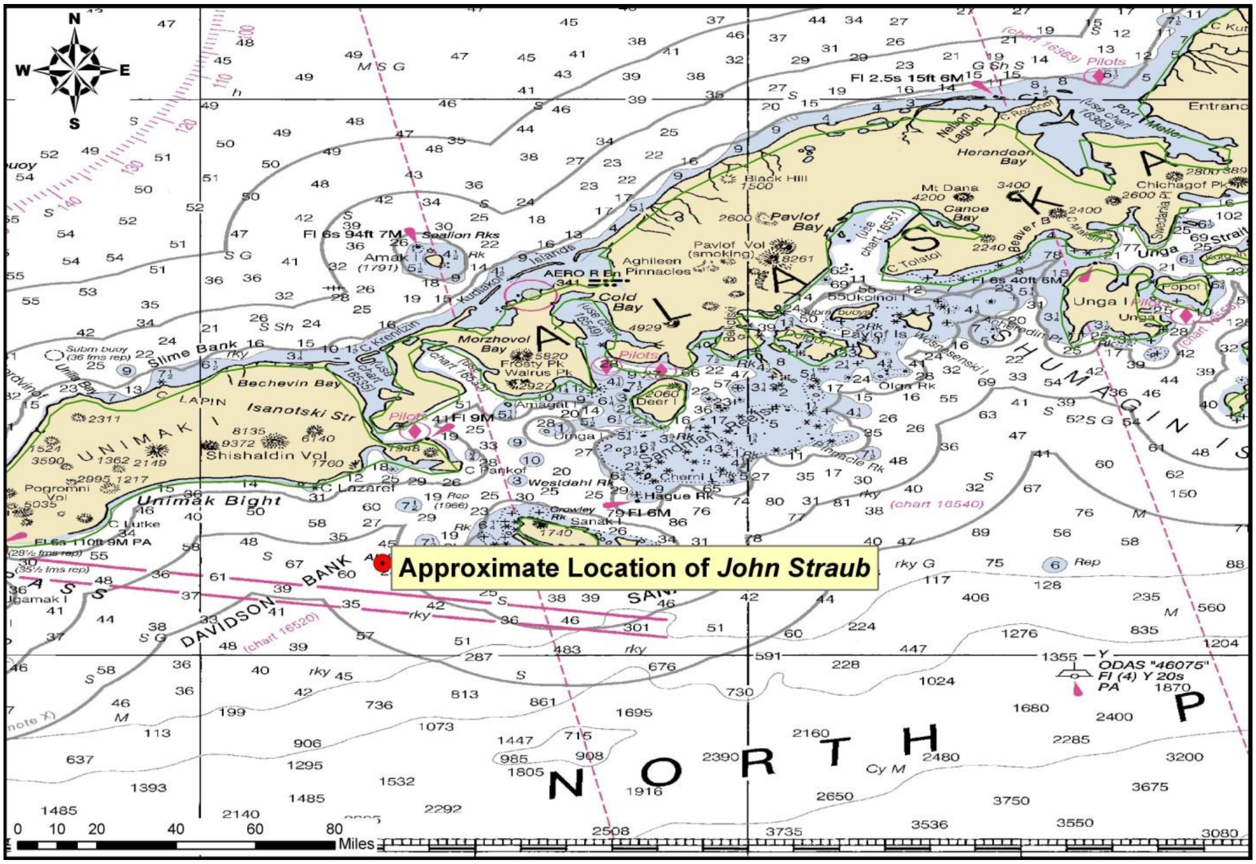


Chart Number: 16006

Casualty Narrative

Vessel sank as a result of explosions believed to have been the result of a Japanese torpedo. The vessel exploded multiple times and broke in half. U.S. forces had to fire upon the stern section to get it to sink but the bow sank immediately.

General Notes

None in the database.

Wreck Condition/Salvage History

Unknown; the wreck has never been located.

Archaeological Assessment

The archaeological assessment provides additional primary source based documentation about the sinking of vessels. It also provides condition-based archaeological assessment of the wrecks when possible. It does not provide a risk-based score or definitively assess the pollution risk or lack thereof from these vessels, but includes additional information that could not be condensed into database form.

Where the current condition of a shipwreck is not known, data from other archaeological studies of similar types of shipwrecks provide the means for brief explanations of what the shipwreck might look like and specifically, whether it is thought there is sufficient structural integrity to retain oil. This is more subjective than the Pollution Potential Tree and computer-generated resource at risk models, and as such provides an additional viewpoint to examine risk assessments and assess the threat posed by these shipwrecks. It also addresses questions of historical significance and the relevant historic preservation laws and regulations that will govern on-site assessments.

In some cases where little additional historic information has been uncovered about the loss of a vessel, archaeological assessments cannot be made with any degree of certainty and were not prepared. For vessels with full archaeological assessments, NOAA archaeologists and contracted archivists have taken photographs of primary source documents from the National Archives that can be made available for future research or on-site activities.

Assessment

The wreck of *John Straub* has never been located, so there are no site reports that would allow NOAA archaeologists to provide a condition based archaeological assessment of the shipwreck. Some additional analysis can be made based on the historic sinking reports of the ship that may be of utility to the U.S. Coast Guard. We know from archival research that the ship was believed to have been struck by one torpedo from a Japanese submarine. The ship suffered two explosions that destroyed the port side of the vessel and caused it to break in half (Figs. 1-1 and 1-2).

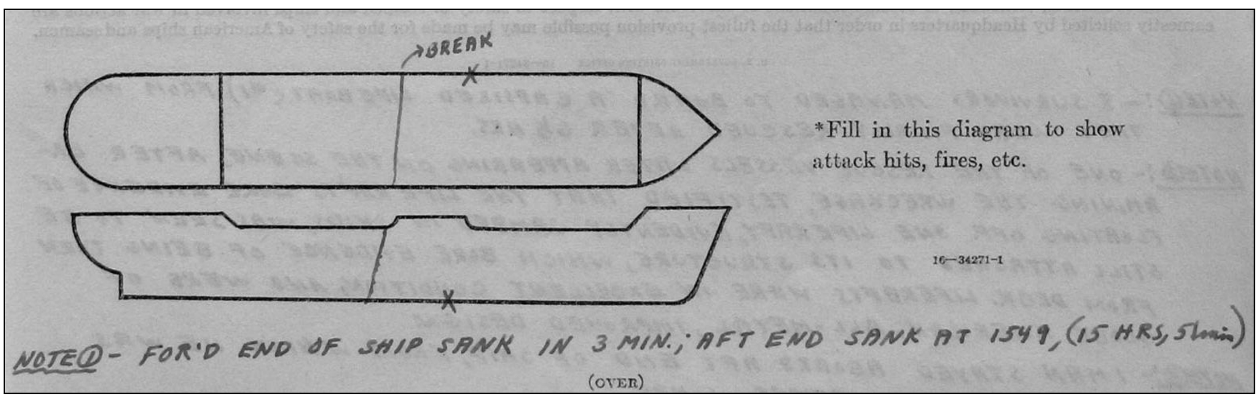


Figure 1-1: U.S. Coast Guard diagram of the location of explosion and hull break on John Straub (Image courtesy of National Archives, Washington, DC).

Based on the large degree of inaccuracy in the reported sinking location and the depths of water the ship was lost in, it is unlikely that the shipwreck will be intentionally located. Although the pictures of the vessel sinking make it appear that substantial amounts of oil was lost when the vessel sank, it is not known if this was the vessel's bunker oil or some of the 9,000 drums of 80 octane gasoline and 25,000 drums of diesel the ship was carrying below decks. Because the shipwreck has never been discovered, it is not possible to determine with any degree of accuracy what the current condition of the wreck is and how likely the vessel is to contain oil.

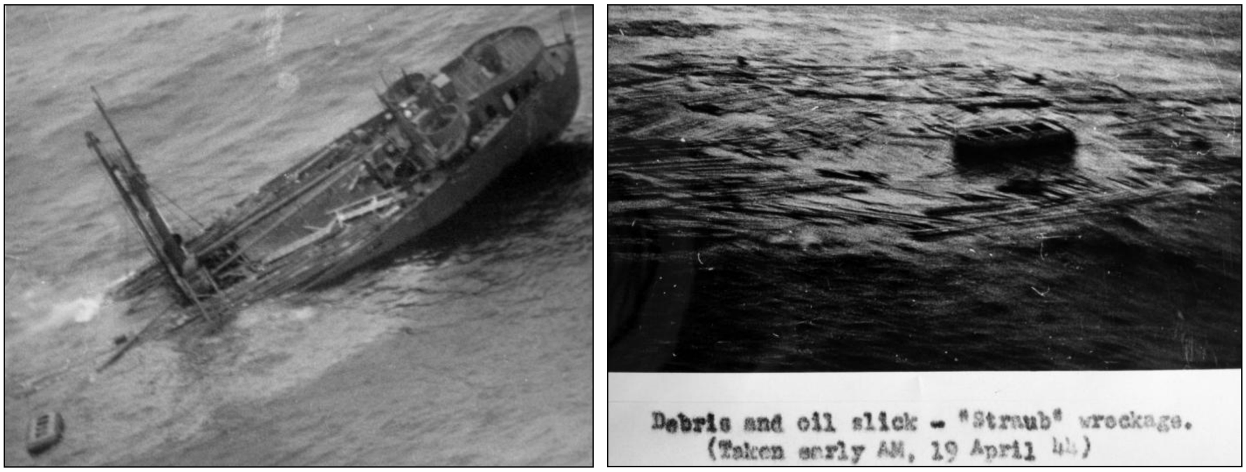


Figure 1-2: U. S. Coast Guard photographs of *John Straub* sinking and the resulting oil slick (Images courtesy of National Archives, Washington, DC).

The only way to conclusively determine the condition of the shipwreck will be to examine the site after it is discovered. Should the vessel be located in a survey of opportunity or due to a mystery spill attributed to this vessel, it should be noted that this vessel is of historic significance and will require appropriate actions be taken under the National Historic Preservation Act (NHPA) and possibly the Sunken Military Craft Act (SMCA) prior to any actions that could impact the integrity of the vessel. This vessel may be eligible for listing on the National Register of Historic Places.

Background Information References

Vessel Image Sources:
http://www.photoship.co.uk/JAlbum%20Ships/Old%20Ships%20J/slides/John%20Straub-01.html

Construction Diagrams or Plans in RULET Database? Yes, ONMS has paper capacity plans for a EC2-S-C1 Type Liberty Ship, additional plans are available through the Smithsonian Institute

Text References:

-United States Coast Guard
War Casualty Section Casualty Reports, 1941 to 1946, Records of the United States Coast Guard, A1 Entry 191, Box 5, Record Group 26, National Archives Building, Washington, DC.

-United States Coast Guard
WW II Reports Concerning Merchant Vessels Sinking, 1938-2002, American, John S. Copley to Joseph Rodman Drake, Records of the United States Coast Guard, Entry P-2, Box 27, Record Group 26, National Archives Building, Washington, DC.

-Google newspaper archives

Vessel Risk Factors

In this section, the risk factors that are associated with the vessel are defined and then applied to the *John Straub* based on the information available. These factors are reflected in the pollution potential risk assessment development by the U.S. Coast Guard Salvage Engineering Response Team (SERT) as a means to apply a salvage engineer's perspective to the historical information gathered by NOAA. This analysis reflected in Figure 1-3 is simple and straightforward and, in combination with the accompanying archaeological assessment, provides a picture of the wreck that is as complete as possible based on current knowledge and best professional judgment. This assessment *does not* take into consideration operational constraints such as depth or unknown location, but rather attempts to provide a replicable and objective screening of the historical date for each vessel. SERT reviewed the general historical information available for the database as a whole and provided a stepwise analysis for an initial indication of Low/Medium/High values for each vessel.

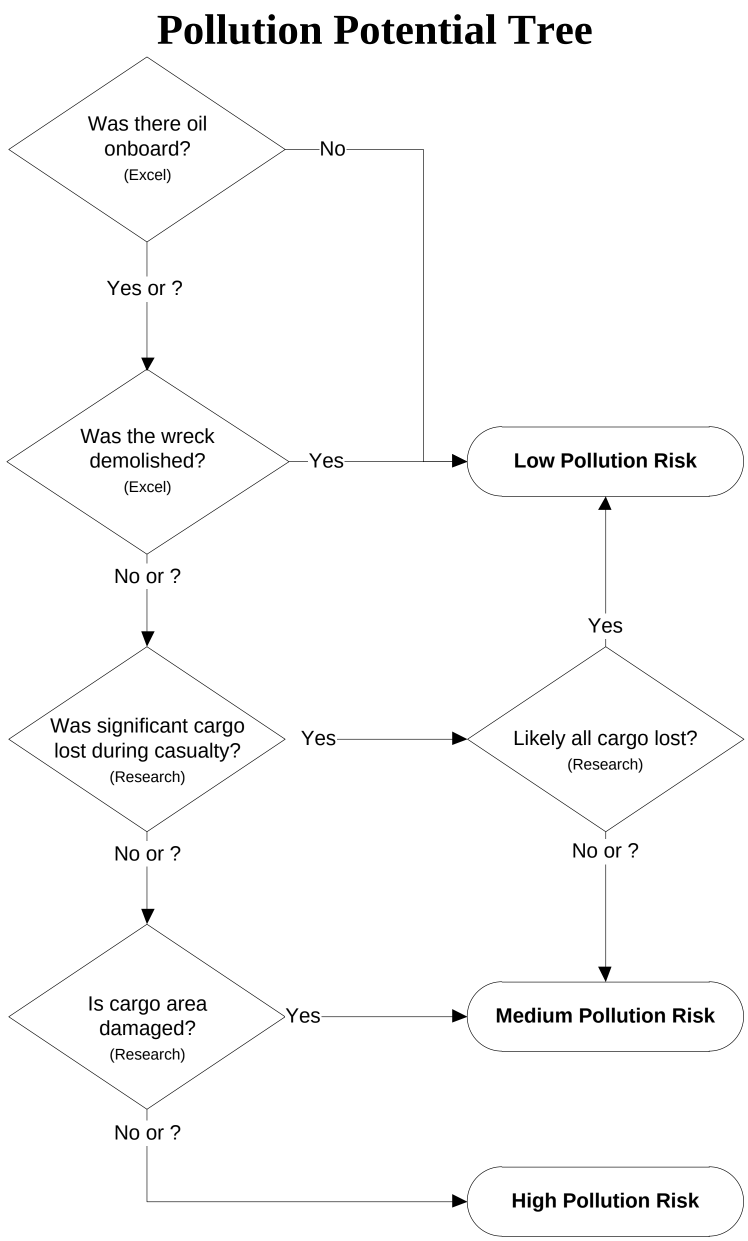


Figure 1-3: U.S. Coast Guard Salvage Engineering Response Team (SERT) developed the above Pollution Potential Decision Tree.

In some instances, nuances from the archaeological assessment may provide additional input that will amend the score for Section 1. Where available, additional information that may have bearing on operational considerations for any assessment or remediation activities is provided.

Each risk factor is characterized as High, Medium, or Low Risk or a category-appropriate equivalent such as No, Unknown, Yes, or Yes Partially. The risk categories correlate to the decision points reflected in Figure 1-3.

Each of the risk factors also has a “data quality modifier” that reflects the completeness and reliability of the information on which the risk ranks were assigned. The quality of the information is evaluated with respect to the factors required for a reasonable preliminary risk assessment. The data quality modifier scale is:

- **High Data Quality:** All or most pertinent information on wreck available to allow for thorough risk assessment and evaluation. The data quality is high and confirmed.
- **Medium Data Quality:** Much information on wreck available, but some key factor data are missing or the data quality is questionable or not verified. Some additional research needed.
- **Low Data Quality:** Significant issues exist with missing data on wreck that precludes making preliminary risk assessment, and/or the data quality is suspect. Significant additional research needed.

In the following sections, the definition of low, medium, and high for each risk factor is provided. Also, the classification for the *John Straub* is provided, both as text and as shading of the applicable degree of risk bullet.

Pollution Potential Factors

Risk Factor A1: Total Oil Volume

The oil volume classifications correspond to the U.S. Coast Guard spill classifications:

- **Low Volume: Minor Spill** <240 bbl (10,000 gallons)
- **Medium Volume: Medium Spill** ≥240 – 2,400 bbl (100,000 gallons)
- **High Volume: Major Spill** ≥2,400 bbl (≥100,000 gallons)

The oil volume risk classifications refer to the volume of the most-likely Worst Case Discharge from the vessel and are based on the amount of oil believed or confirmed to be on the vessel.

The *John Straub i*s ranked as High Volume because it is thought to have a potential for up to 12,054 bbl, although some of that was lost at the time of the casualty due to the explosion and breakup of the vessel. Data quality is medium.

The risk factor for volume also incorporates any reports or anecdotal evidence of actual leakage from the vessel or reports from divers of oil in the overheads, as opposed to potential leakage. This reflects the history of the vessel’s leakage. There are no reports of leakage from the *John Straub*.

Risk Factor A2: Oil Type

The oil type(s) on board the wreck are classified only with regard to persistence, using the U.S. Coast Guard oil grouping[1]. (Toxicity is dealt with in the impact risk for the Resources at Risk classifications.) The three oil classifications are:

- **Low Risk: Group I Oils** – non-persistent oil (e.g., gasoline)
- **Medium Risk: Group II – III Oils** – medium persistent oil (e.g., diesel, No. 2 fuel, light crude, medium crude)
- **High Risk: Group IV** – high persistent oil (e.g., heavy crude oil, No. 6 fuel oil, Bunker C)

The *John Straub* is classified as High Risk because the bunker oil is heavy fuel oil, a Group IV oil type, although the vessel also carried 9,000 drums of 80 octane gasoline and 25,000 drums of diesel oil. Data quality is high.

Was the wreck demolished?

Risk Factor B: Wreck Clearance

This risk factor addresses whether or not the vessel was historically reported to have been demolished as a hazard to navigation or by other means such as depth charges or aerial bombs. This risk factor is based on historic records and does not take into account what a wreck site currently looks like. The risk categories are defined as:

- **Low Risk:** The wreck was reported to have been entirely destroyed after the casualty
- **Medium Risk:** The wreck was reported to have been partially cleared or demolished after the casualty
- **High Risk:** The wreck was not reported to have been cleared or demolished after the casualty
- **Unknown:** It is not known whether or not the wreck was cleared or demolished at the time of or after the casualty

The *John Straub* is classified as High Risk because there are no known historic accounts of the wreck being demolished as a hazard to navigation. Data quality is high.

Was significant cargo or bunker lost during casualty?

Risk Factor C1: Burning of the Ship

This risk factor addresses any burning that is known to have occurred at the time of the vessel casualty and may have resulted in oil products being consumed or breaks in the hull or tanks that would have increased the potential for oil to escape from the shipwreck. The risk categories are:

- **Low Risk:** Burned for multiple days
- **Medium Risk:** Burned for several hours
- **High Risk:** No burning reported at the time of the vessel casualty

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[1] Group I Oil or Nonpersistent oil is defined as "a petroleum-based oil that, at the time of shipment, consists of hydrocarbon fractions: At least 50% of which, by volume, distill at a temperature of 340°C (645°F); and at least 95% of which, by volume, distill at a temperature of 370°C (700°F)."
Group II - Specific gravity less than 0.85 crude [API° >35.0]
Group III - Specific gravity between 0.85 and less than .95 [API° ≤35.0 and >17.5]
Group IV - Specific gravity between 0.95 to and including 1.0 [API° ≤17.5 and >10.0]

- **Unknown:** It is not known whether or not the vessel burned at the time of the casualty

The *John Straub* is classified as High Risk because there was a report of fire at the time of casualty. Data quality is high.

Risk Factor C2: Reported Oil on the Water

This risk factor addresses reports of oil on the water at the time of the vessel casualty. The amount is relative and based on the number of available reports of the casualty. Seldom are the reports from trained observers so this is very subjective information. The risk categories are defined as:

- **Low Risk:** Large amounts of oil reported on the water by multiple sources
- **Medium Risk:** Moderate to little oil reported on the water during or after the sinking event
- **High Risk:** No oil reported on the water
- **Unknown:** It is not known whether or not there was oil on the water at the time of the casualty

The *John Straub* is classified as Medium Risk because the oil was reported to have spread across the water as the vessel went down. Data quality is high.

Is the cargo area damaged?

Risk Factor D1: Nature of the Casualty

This risk factor addresses the means by which the vessel sank. The risk associated with each type of casualty is determined by the how violent the sinking event was and the factors that would contribute to increased initial damage or destruction of the vessel (which would lower the risk of oil, other cargo, or munitions remaining on board). The risk categories are:

- **Low Risk:** Multiple torpedo detonations, multiple mines, severe explosion
- **Medium Risk:** Single torpedo, shellfire, single mine, rupture of hull, breaking in half, grounding on rocky shoreline
- **High Risk:** Foul weather, grounding on soft bottom, collision
- **Unknown:** The cause of the loss of the vessel is not known

The *John Straub* is classified as Low Risk because there were multiple explosions, and the vessel broke into two sections. Data quality is high.

Risk Factor D2: Structural Breakup

This risk factor takes into account how many pieces the vessel broke into during the sinking event or since sinking. This factor addresses how likely it is that multiple components of a ship were broken apart including tanks, valves, and pipes. Experience has shown that even vessels broken in three large sections can still have significant pollutants on board if the sections still have some structural integrity. The risk categories are:

- **Low Risk:** The vessel is broken into more than three pieces
- **Medium Risk:** The vessel is broken into two-three pieces
- **High Risk:** The vessel is not broken and remains as one contiguous piece
- **Unknown:** It is currently not known whether or not the vessel broke apart at the time of loss or after sinking

The *John Straub* is classified as Medium Risk because it broke into at least two pieces at the time of casualty; whether additional structural breakup occurred is unknown as location is unknown. Data quality is high.

Factors That May Impact Potential Operations

Orientation (degrees)

This factor addresses what may be known about the current orientation of the intact pieces of the wreck (with emphasis on those pieces where tanks are located) on the seafloor. For example, if the vessel turtled, not only may it have avoided demolition as a hazard to navigation, but it has a higher likelihood of retaining an oil cargo in the non-vented and more structurally robust bottom of the hull.

The location of the *John Straub* is unknown. Data quality is low.

Depth

Depth information is provided where known. In many instances, depth will be an approximation based on charted depths at the last known locations.

The depth for *John Straub* is believed to be about 200 feet based on the last known location. Data quality is low.

Visual or Remote Sensing Confirmation of Site Condition

This factor takes into account what the physical status of wreck site as confirmed by remote sensing or other means such as ROV or diver observations and assesses its capability to retain a liquid cargo. This assesses whether or not the vessel was confirmed as entirely demolished as a hazard to navigation, or severely compromised by other means such as depth charges, aerial bombs, or structural collapse.

The location of the *John Straub* is unknown. Data quality is low.

Other Hazardous (Non-Oil) Cargo on Board

This factor addresses hazardous cargo other than oil that may be on board the vessel and could potentially be released, causing impacts to ecological and socio-economic resources at risk.

The *John Straub* also carried a cargo of explosives. Data quality is high.

Munitions on Board

This factor addresses hazardous cargo other than oil that may be on board the vessel and could potentially be released or detonated causing impacts to ecological and socio-economic resources at risk.

The *John Straub* had munitions for onboard weapons, but the types of weapons the ship carried is not known. Data quality is high.

Vessel Pollution Potential Summary

Table 1-1 summarizes the risk factor scores for the pollution potential and mitigating factors that would reduce the pollution potential for the *John Straub*. Operational factors are listed but do not have a risk score.

Table 1-1: Summary matrix for the vessel risk factors for the *John Straub* color-coded as red (high risk), yellow (medium risk), and green (low risk).

Vessel Risk Factors		Data Quality Score	Comments	Risk Score
Pollution Potential Factors	A1: Oil Volume (total bbl)	Medium	Maximum of 12,054 bbl, not reported to be leaking	**Med**
	A2: Oil Type	High	Bunker fuel is a heavy fuel oil, a Group IV oil type	
	B: Wreck Clearance	High	Vessel not reported as cleared	
	C1: Burning of the Ship	High	Fire was reported	
	C2: Oil on Water	High	Oil was reported on the water; amount is not known	
	D1: Nature of Casualty	High	Multiple explosions	
	D2: Structural Breakup	High	The vessel broke in two at the time of sinking	
Archaeological Assessment	Archaeological Assessment	High	Detailed sinking records and photographs of this ship exist, assessment is believed to be very accurate	**Not Scored**
Operational Factors	Wreck Orientation	Low	Unknown	**Not Scored**
	Depth	Low	~ 200 ft	
	Visual or Remote Sensing Confirmation of Site Condition	Low	Location unknown	
	Other Hazardous Materials Onboard	High	Explosives	
	Munitions Onboard	High	Munitions for onboard weapons	
	Gravesite (Civilian/Military)	High	No	
	Historical Protection Eligibility (NHPA/SMCA)	High	NHPA and SMCA	

SECTION 2: ENVIRONMENTAL IMPACT MODELING

To help evaluate the potential transport and fates of releases from sunken wrecks, NOAA worked with RPS ASA to run a series of generalized computer model simulations of potential oil releases. The results are used to assess potential impacts to ecological and socio-economic resources, as described in Sections 3 and 4. The modeling results are useful for this screening-level risk assessment; however, it should be noted that detailed site/vessel/and seasonally specific modeling would need to be conducted prior to any intervention on a specific wreck.

Release Scenarios Used in the Modeling

The potential volume of leakage at any point in time will tend to follow a probability distribution. Most discharges are likely to be relatively small, though there could be multiple such discharges. There is a lower probability of larger discharges, though these scenarios would cause the greatest damage. A **Worst Case Discharge** (WCD) would involve the release of all of the cargo oil and bunkers present on the vessel In the case of the *John Straub* this would be about 13,000 bbl (rounded up from 12,054 bbl) based on current estimates of the amount of oil remaining onboard the wreck.

The likeliest scenario of oil release from most sunken wrecks, including the *John Straub*, is a small, episodic release that may be precipitated by disturbance of the vessel in storms. Each of these episodic releases may cause impacts and require a response. **Episodic** releases are modeled using 1% of the WCD. Another scenario is a very low chronic release, i.e., a relatively regular release of small amounts of oil that causes continuous oiling and impacts over the course of a long period of time. This type of release would likely be precipitated by corrosion of piping that allows oil to flow or bubble out at a slow, steady rate. **Chronic** releases are modeled using 0.1% of the WCD.

The **Most Probable** scenario is premised on the release of all the oil from one tank. In the absence of information on the number and condition of the cargo or fuel tanks for all the wrecks being assessed, this scenario is modeled using 10% of the WCD. The **Large** scenario is loss of 50% of the WCD. The five major types of releases are summarized in Table 2-1. The actual type of release that occurs will depend on the condition of the vessel, time factors, and disturbances to the wreck. Note that, the episodic and chronic release scenarios represent a small release that is repeated many times, potentially repeating the same magnitude and type of impact(s) with each release. The actual impacts would depend on the environmental factors such as real-time and forecast winds and currents during each release and the types/quantities of ecological and socio-economic resources present.

The model results here are based on running the RPS ASA Spill Impact Model Application Package (SIMAP) two hundred times for each of the five spill volumes shown in Table 2-1. The model randomly selects the date of the release, and corresponding environmental, wind, and ocean current information from a long-term wind and current database.

When a spill occurs, the trajectory, fate, and effects of the oil will depend on environmental variables, such as the wind and current directions over the course of the oil release, as well as seasonal effects. The magnitude and nature of potential impacts to resources will also generally have a strong seasonal component (e.g., timing of bird migrations, turtle nesting periods, fishing seasons, and tourism seasons).

Table 2-1: Potential oil release scenario types for the *John Straub*.

Scenario Type	Release per Episode	Time Period	Release Rate	Relative Likelihood	Response Tier
Chronic (0.1% of WCD)	13 bbl	Fairly regular intervals or constant	100 bbl over several days	More likely	Tier 1
Episodic (1% of WCD)	130 bbl	Irregular intervals	Over several hours or days	Most Probable	Tier 1-2
Most Probable (10% of WCD)	1,300 bbl	One-time release	Over several hours or days	Most Probable	Tier 2
Large (50% of WCD)	6,500 bbl	One-time release	Over several hours or days	Less likely	Tier 2-3
Worst Case	13,000 bbl	One-time release	Over several hours or days	Least likely	Tier 3

The modeling results represent 200 simulations for each spill volume with variations in spill trajectory based on winds and currents. The spectrum of the simulations gives a perspective on the variations in likely impact scenarios. Some resources will be impacted in nearly all cases; some resources may not be impacted unless the spill trajectory happens to go in that direction based on winds and currents at the time of the release and in its aftermath.

For the large and WCD scenarios, the duration of the release was assumed to be 12 hours, envisioning a storm scenario where the wreck is damaged or broken up, and the model simulations were run for a period of 30 days. The releases were assumed to be from a depth between 2-3 meters above the sea floor, using the information known about the wreck location and depth.

It is important to acknowledge that these scenarios are only for this screening-level assessment. Detailed site/vessel/and seasonally specific modeling would need to be conducted prior to any intervention on a specific wreck.

Oil Type for Release

The *John Straub* contained a maximum of 12,054 bbl of heavy fuel oil (a Group IV oil) as bunker fuel oil. Thus, the oil spill model was run using heavy fuel oil.

Oil Thickness Thresholds

The model results are reported for different oil thickness thresholds, based on the amount of oil on the water surface or shoreline and the resources potentially at risk. Table 2-2 shows the terminology and thicknesses used in this report, for both oil thickness on water and the shoreline. For oil on the water surface, a thickness of 0.01 g/m^2, which would appear as a barely visible sheen, was used as the threshold for socio-economic impacts because often fishing is prohibited in areas with any visible oil, to prevent contamination of fishing gear and catch. A thickness of 10 g/m^2 was used as the threshold for ecological impacts, primarily due to impacts to birds, because that amount of oil has been observed to be enough to mortally impact birds and other wildlife. In reality, it is very unlikely that oil would be evenly distributed on the water surface. Spilled oil is always distributed patchily on the water surface in bands or tarballs with clean water in between. So, Table 2-2a shows the number of tarballs per acre on the water surface for these oil thickness thresholds, assuming that each tarball was a sphere that was 1 inch in diameter.

For oil stranded onshore, a thickness of 1 g/m^2 was used as the threshold for socio-economic impacts because that amount of oil would conservatively trigger the need for shoreline cleanup on amenity beaches. A thickness of 100 g/m^2 was used as the threshold for ecological impacts based on a synthesis of the literature showing that shoreline life has been affected by this degree of oiling.[2] Because oil often strands onshore as tarballs, Table 2-2b shows the number of tarballs per m^2 on the shoreline for these oil thickness thresholds, assuming that each tarball was a sphere that was 1 inch in diameter.

Table 2-2a: Oil thickness thresholds used in calculating area of water impacted. Refer to Sections 3 and 4 for explanations of the thresholds for ecological and socio-economic resource impacts.

Oil Description	Sheen Appearance	Approximate Sheen Thickness		No. of 1 inch Tarballs	Threshold/Risk Factor
Oil Sheen	Barely Visible	0.00001 mm	0.01 g/m^2	~5-6 tarballs per acre	Socio-economic Impacts to Water Surface/Risk Factor 4B-1 and 2
Heavy Oil Sheen	Dark Colors	0.01 mm	10 g/m^2	~5,000-6,000 tarballs per acre	Ecological Impacts to Water Surface/ Risk Factor 3B-1 and 2

Table 2-2b: Oil thickness thresholds used in calculating miles of shoreline impacted. Refer to Sections 3 and 4 for explanations of the thresholds for ecological and socio-economic resource impacts.

Oil Description	Oil Appearance	Approximate Sheen Thickness		No. of 1 inch Tarballs	Threshold/Risk Factor
Oil Sheen/Tarballs	Dull Colors	0.001 mm	1 g/m^2	~0.12-0.14 tarballs/m^2	Socio-economic Impacts to Shoreline Users/Risk Factor 4C-1 and 2
Oil Slick/Tarballs	Brown to Black	0.1 mm	100 g/m^2	~12-14 tarballs/m^2	Ecological Impacts to Shoreline Habitats/Risk Factor 3C-1 and 2

Potential Impacts to the Water Column

Impacts to the water column from an oil release from the *John Straub* will be determined by the volume of leakage. Because oil from sunken vessels will be released at low pressures, the droplet sizes will be large enough for the oil to float to the surface. Therefore, impacts to water column resources will result from the natural dispersion of the floating oil slicks on the surface, which is limited to about the top 33 feet. The metric used for ranking impacts to the water column is the area of water surface in mi^2 that has been contaminated by 1 part per billion (ppb) oil to a depth of 33 feet. At 1 ppb, there are likely to be impacts to sensitive organisms in the water column and potential tainting of seafood, so this concentration is used as a screening threshold for both the ecological and socio-economic risk factors for water column resource impacts. To assist planners in understanding the scale of potential impacts for different leakage volumes, a regression curve was generated for the water column volume oiled using the five volume scenarios, which is shown in Figure 2-1. Using this figure, the water column impacts can be estimated for any spill volume. Note that the water column impact decreases for the worst case discharge spill volume, because a significant amount of oil is removed from the water column due to sedimentation in the modeling results for the *Hamlet*. Increased sedimentation will increase impacts to benthic habitats.

[2] French, D., M. Reed, K. Jayko, S. Feng, H. Rines, S. Pavignano, T. Isaji, S. Puckett, A. Keller, F. W. French III, D. Gifford, J. McCue, G. Brown, E. MacDonald, J. Quirk, S. Natzke, R. Bishop, M. Welsh, M. Phillips and B.S. Ingram, 1996. The CERCLA type A natural resource damage assessment model for coastal and marine environments (NRDAM/CME), Technical Documentation, Vol. I - V. Office of Environmental Policy and Compliance, U.S. Dept. of the Interior, Washington, DC.

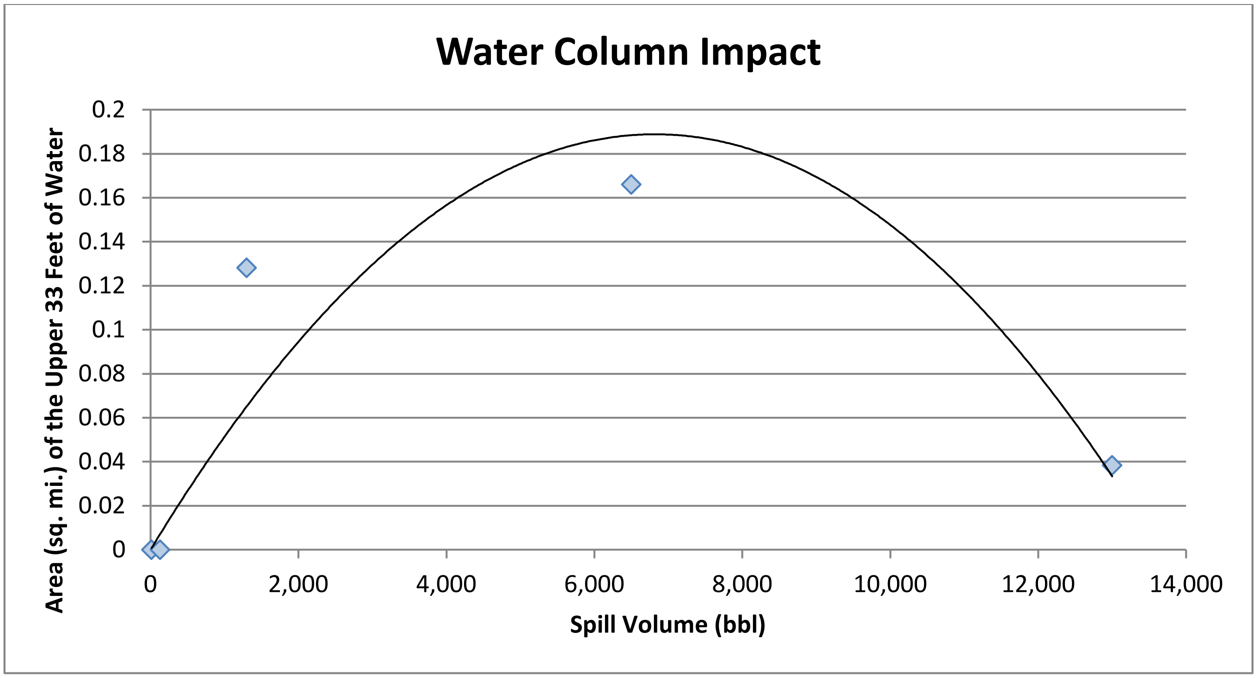

Figure 2-1: Regression curve for estimating the volume of water column at or above 1 ppb aromatics impacted as a function of spill volume for the *John Straub*.

Potential Water Surface Slick

The slick size from an oil release from the *John Straub* is a function of the quantity released. The estimated water surface coverage by a fresh slick (the total water surface area "swept" by oil over time) for the various scenarios is shown in Table 2-3, as the mean result of the 200 model runs. Note that this is an estimate of total water surface affected over a 30-day period. In the model, the representative heavy fuel oil used for this analysis spreads to a minimum thickness of approximately 975 g/m^2, and is not able to spread any thinner. As a result, water surface oiling results are identical for the 0.01 and 10 g/m^2 thresholds. The slick will not be continuous but rather be broken and patchy due to the subsurface release of the oil. Surface expression is likely to be in the form of sheens, tarballs, and streamers.

Table 2-3: Estimated slick area swept on water for oil release scenarios from the *John Straub*.

Scenario Type	Oil Volume (bbl)	Estimated Slick Area Swept Mean of All Models	
		0.01 g/m^2	10 g/m^2
Chronic	13	79 mi^2	79 mi^2
Episodic	130	250 mi^2	250 mi^2
Most Probable	1,300	860 mi^2	860 mi^2
Large	6,500	2,200 mi^2	2,200 mi^2
Worst Case Discharge	13,000	3,300 mi^2	3,300 mi^2

The location, size, shape, and spread of the oil slick(s) from an oil release will depend on environmental conditions, including winds and currents, at the time of release and in its aftermath. The areas potentially affected by oil slicks, given that we cannot predict when the spill might occur and the range of possible wind and current conditions that might prevail after a release, are shown in Figure 2-2 and Figure 2-3 using the Most Probable volume and the socio-economic and ecological thresholds.

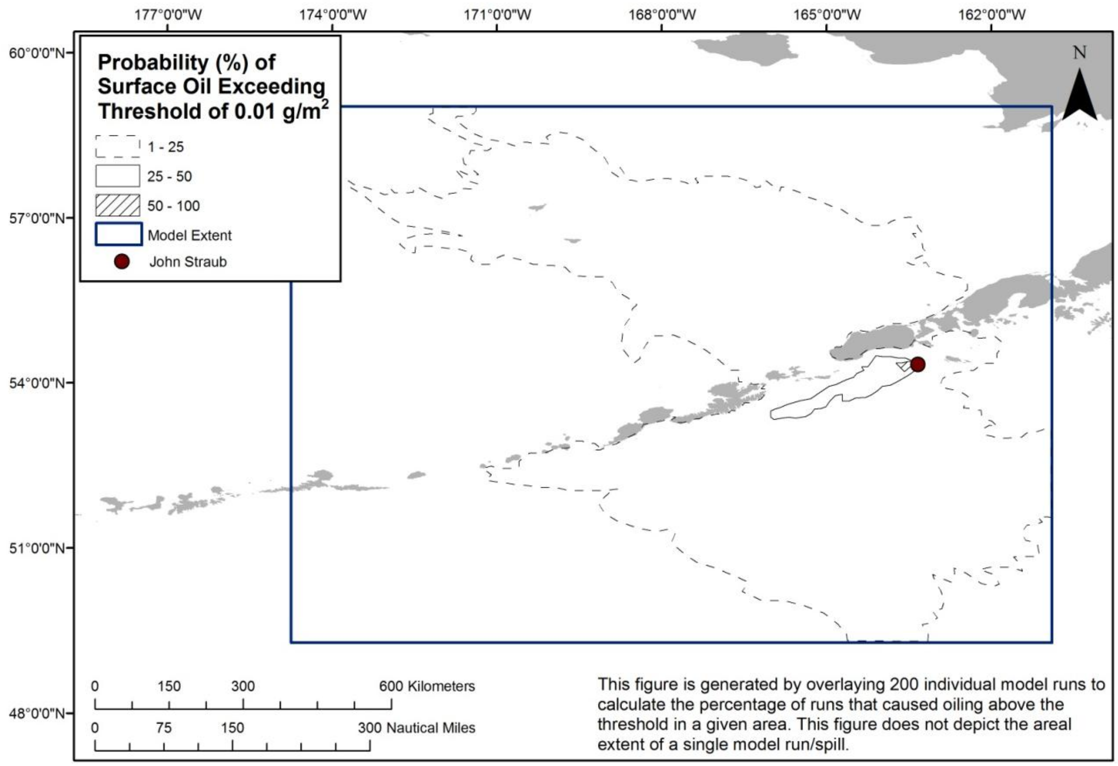

Figure 2-2: Probability of surface oil (exceeding 0.01 g/m^2) from the Most Probable spill of 1,300 bbl of heavy fuel oil from the *John Straub* at the threshold for socio-economic resources at risk.

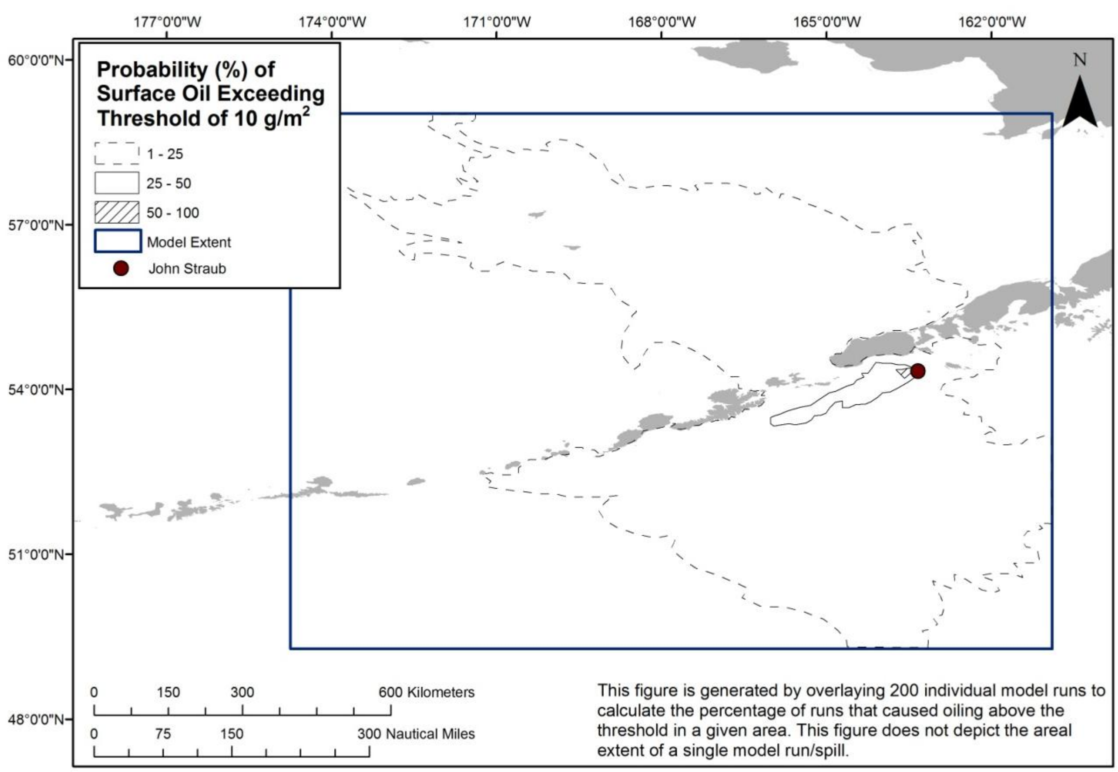

Figure 2-3: Probability of surface oil (exceeding 10 g/m^2) from the Most Probable spill of 1,300 bbl of heavy fuel oil from the *John Straub* at the threshold for ecological resources at risk.

The maximum potential cumulative area swept by oil slicks at some time after a Most Probable Discharge is shown in Figure 2-4 as the timing of oil movements.

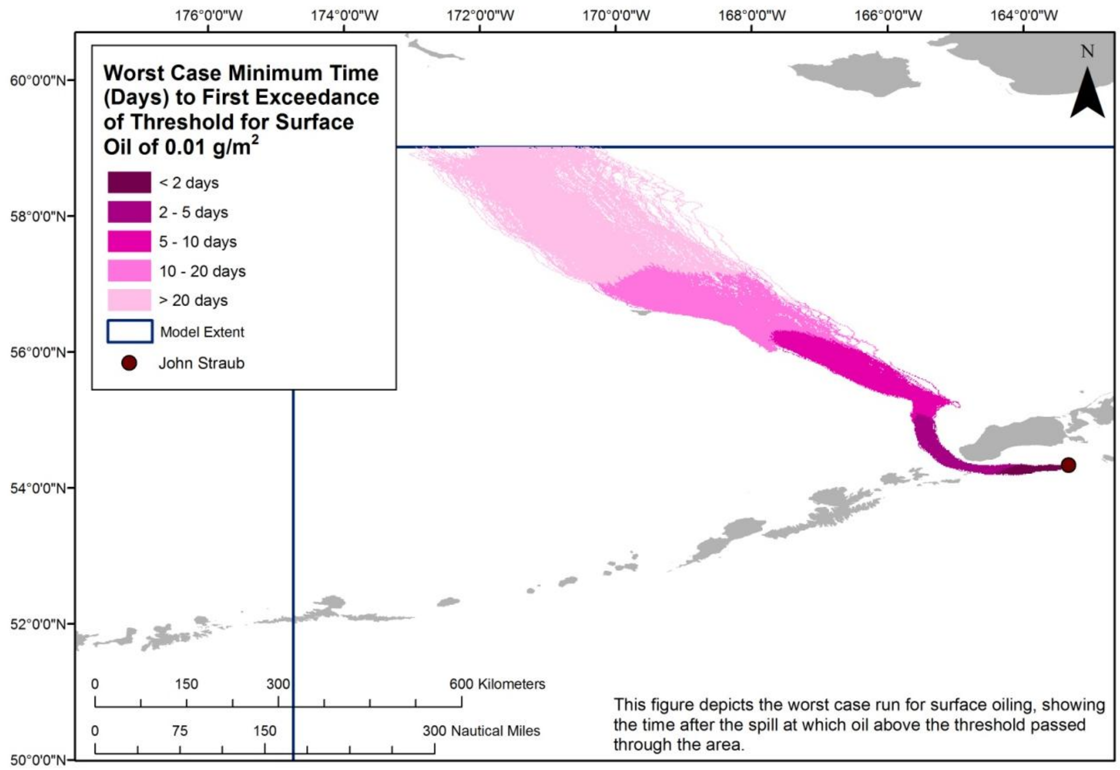

Figure 2-4: Water surface oiling from the Most Probable spill of 1,300 bbl of heavy fuel oil from the *John Straub* shown as the area over which the oil spreads at different time intervals.

The actual area affected by a release will be determined by the volume of leakage, whether it is from one or more tanks at a time. To assist planners in understanding the scale of potential impacts for different leakage volumes, a regression curve was generated for the water surface area oiled using the five volume scenarios, which is shown in Figure 2-5. Using this figure, the area of water surface with a barely visible sheen can be estimated for any spill volume.

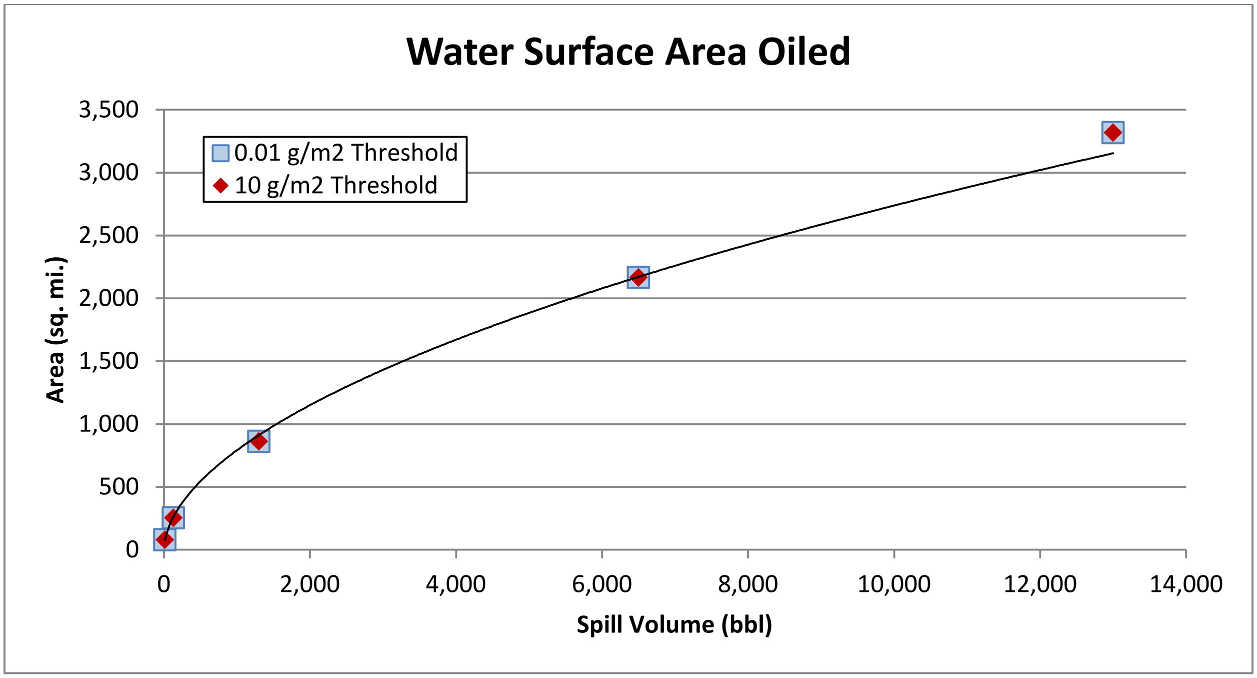

Figure 2-5: Regression curve for estimating the amount of water surface oiling as a function of spill volume for the *John Straub*, showing both the ecological threshold of 10 g/m^2 and socio-economic threshold of 0.01 g/m^2.

Potential Shoreline Impacts

Based on these modeling results, shorelines along the southern Alaska Peninsula and upper Aleutian Islands are at risk. Figure 2-6 shows the probability of oil stranding on the shoreline at concentrations that exceed the threshold of 1 g/m^2, for the Most Probable release of 1,300 bbl. However, the specific areas that would be oiled will depend on the currents and winds at the time of the oil release(s), as well as on the amount of oil released. Figure 2-7 shows the single oil spill scenario that resulted in the maximum extent of shoreline oiling for the Most Probable volume. Estimated miles of shoreline oiling above the threshold of 1 g/m^2 by scenario type are shown in Table 2-4.

Table 2-4: Estimated shoreline oiling from leakage from the *John Straub*.

Scenario Type	Volume (bbl)	Estimated Miles of Shoreline Oiling Above 1 g/m^2			
		Rock/Gravel/Artificial	Sand	Wetland/Mudflat	Total
Chronic	613	4	1	0	5
Episodic	130	12	7	0	19
Most Probable	1,300	17	13	0	30
Large	6,500	22	15	0	37
Worst Case Discharge	13,000	26	17	0	43

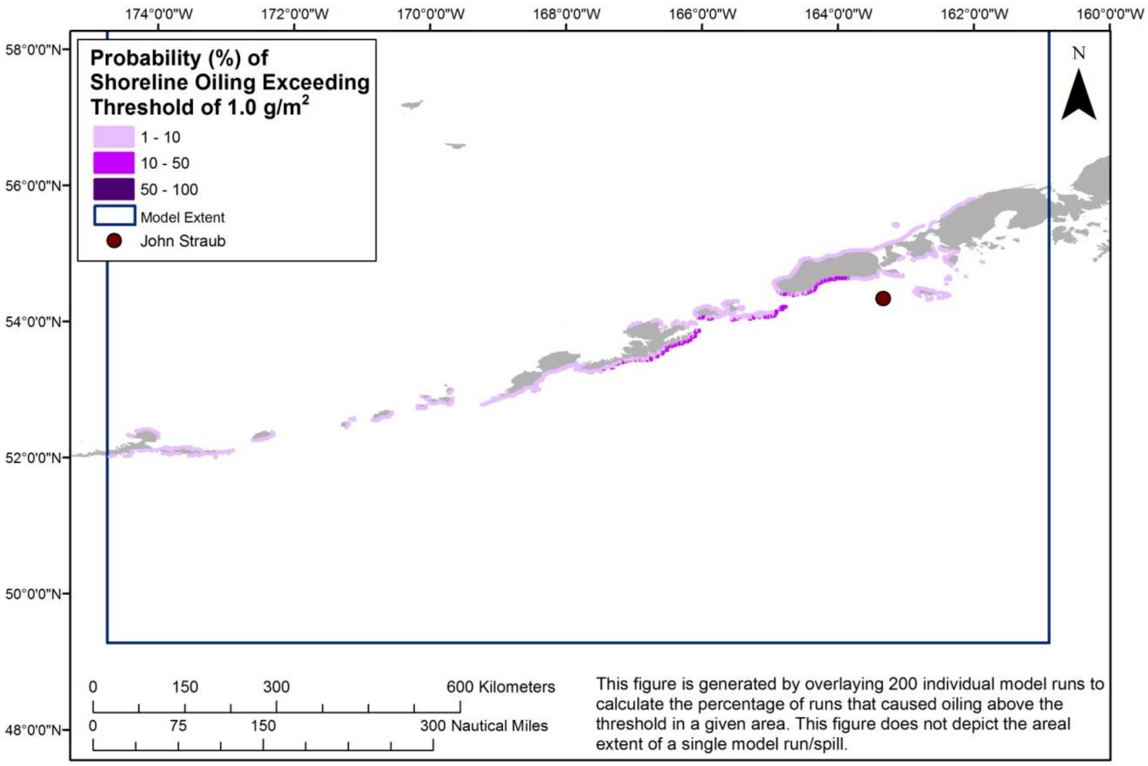

Figure 2-6: Probability of shoreline oiling (exceeding 1.0 g/m²) from the Most Probable Discharge of 1,300 bbl of heavy fuel oil from the *John Straub*.

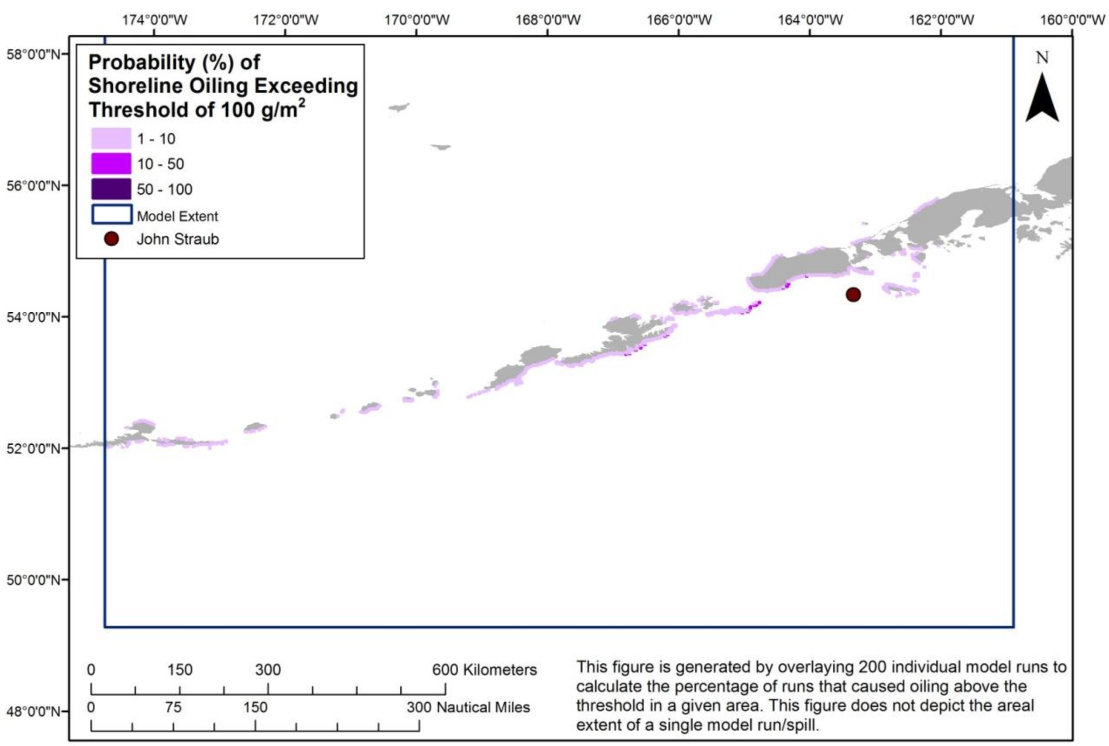

Figure 2-7: The extent and degree of shoreline oiling from the single model run of the Most Probable Discharge of 1,300 bbl of heavy fuel oil from the *John Straub* that resulted in the greatest shoreline oiling.

The actual shore length affected by a release will be determined by the volume of leakage and environmental conditions during an actual release. To assist planners in scaling the potential impact for different leakage volumes, a regression curve was generated for the total shoreline length oiled using the five volume scenarios, which is shown in Figure 2-8. Using this figure, the shore length oiled can be estimated for any spill volume.

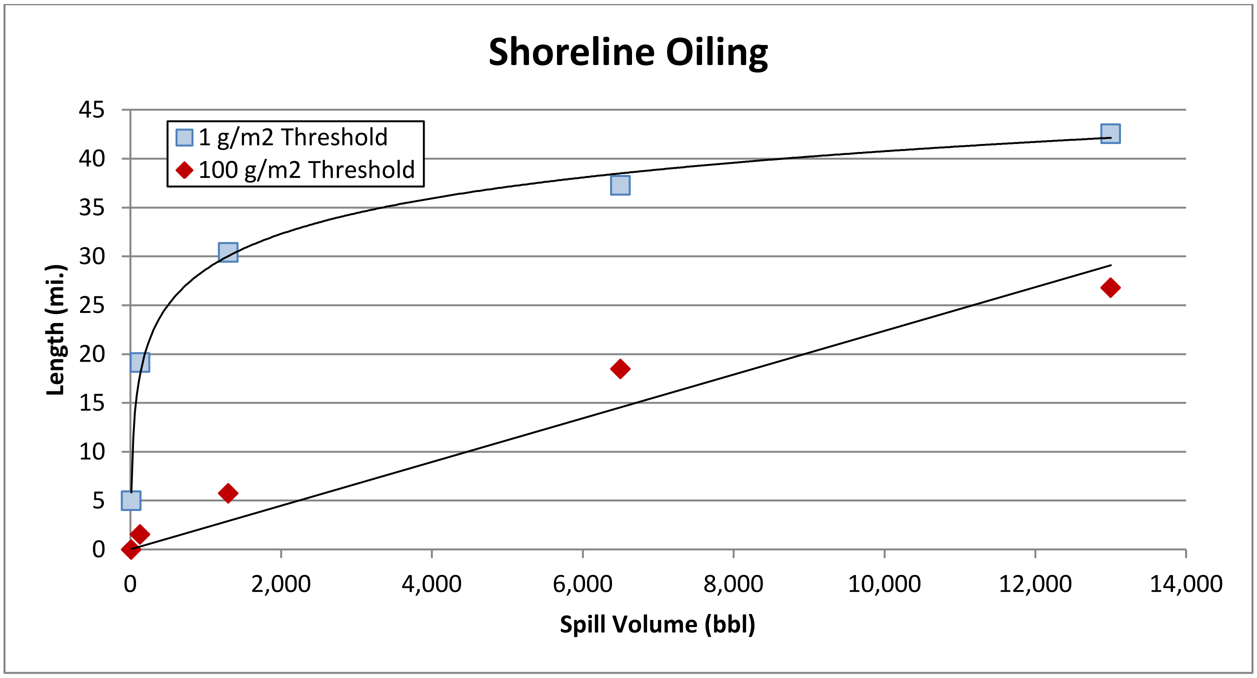

Figure 2-8: Regression curve for estimating the amount of shoreline oiling at different thresholds as a function of spill volume for the *John Straub*.

The worst case scenario for shoreline exposure along the potentially impacted area for the WCD volume (Table 2-5) and the Most Probable volume (Table 2-6) consists of rocky shores and gravel beaches.

Table 2-5: Worst case scenario shoreline impact by habitat type and oil thickness for a leakage of 13,000 bbl from the *John Straub*.

Shoreline/Habitat Type	Lighter Oiling Oil Thickness <1 mm Oil Thickness >1 g/m^2	Heavier Oiling Oil Thickness >1 mm Oil Thickness >100 g/m^2
Rocky and artificial shores/Gravel beaches	176 miles	128 miles
Sand beaches	2 miles	0 miles
Salt marshes and tidal flats	0 miles	0 miles

Table 2-6: Worst case scenario shoreline impact by habitat type and oil thickness for a leakage of 1,300 bbl from the *John Straub*.

Shoreline/Habitat Type	Lighter Oiling Oil Thickness <1 mm Oil Thickness >1 g/m^2	Heavier Oiling Oil Thickness >1 mm Oil Thickness >100 g/m^2
Rocky and artificial shores/Gravel beaches	139 miles	4 miles
Sand beaches	0 miles	0 miles
Salt marshes and tidal flats	0 miles	0 miles

SECTION 3: ECOLOGICAL RESOURCES AT RISK

Ecological resources at risk from a catastrophic release of oil from the *John Straub* (Table 3-1) include numerous guilds of birds, particularly those sensitive to surface oiling while rafting or plunge diving to feed. Ten to fifteen million seabirds nest in the Aleutian Islands, and sheltered lagoons and tidal flats serve as migratory habitat for shorebirds and waterfowl. Several passes aggregate prey species and provide foraging grounds for marine mammals and seabirds. The Pribilof Islands are the largest rookery in the world for Northern fur seals and are major seabird nesting habitat. In addition, this region contains productive commercial fisheries for fish and invertebrates and subsistence fisheries for marine mammals.

Table 3-1: Ecological resources at risk from a release of oil from the *John Straub.*
(FT = Federal threatened; FE = Federal endangered; ST = State threatened; SE = State endangered).

Species Group	Species Subgroup and Geography	Seasonal Presence
Pelagic Birds	Passes aggregate prey and are important foraging habitat for sea birds, including species of shearwaters, auklets, murres, cormorants, and albatross, including the short-tailed albatross (FE) • Slime bank and other offshore areas are important foraging habitats for short-tailed shearwater and other seabirds • Unimak Pass is especially important for whiskered auklet (up to 50% of breeding population uses the pass during breeding season) and short-tailed shearwater o Parakeet auklet, pigeon guillemot, tufted puffin; black-footed albatrosses also forage here in the summer • Akutan Pass has high numbers of whiskered auklets • Pribilof Islands are near rich areas of upwelling offshore, supporting large concentrations of pelagic birds • Whiskered auklet is rarest seabird in U.S. and is endemic to islands along the southern boundary of the Bering Sea (total population is 116,000 birds) • Murres are present year round, migrate south of the ice edge in the winter and can form large rafts (>250,000 birds)	Auklets and murres present year round, breeding Apr-Sep Shearwaters present during the summer Albatrosses present during the summer
Waterfowl and shorebirds	Aleutians are a major spring and fall staging area for migrating waterfowl as well as a permanent residence for some species. Common waterfowl species include: brant, common eider, emperor goose, greater scaup, king eider, mallard, northern pintail, oldsquaw, red-breasted merganser, scoters, Steller's eider, black scoter, American wigeon, bufflehead, Canada goose, common goldeneye, gadwall, green-winged teal, harlequin duck, northern shoveler, scoter spp., surf scoter, white-winged scoter Izembek and nearby lagoons are globally important staging area for waterfowl, shorebirds and geese prior to transoceanic migrations • >90% of the Pacific population of brant, >50% of the population of emperor geese, a significant percentage of the world population of Steller's eider (FT) and cackling goose all use these areas • >28 spp. of shorebirds (maximum daily counts can exceed 40,000); rock sandpiper, dunlin and least sandpipers most common *Pribilof Islands* • Salt Lagoon is important for post-breeding shorebirds (rock sandpiper breeds here; ruddy turnstone is most abundant migrant) and wintering sea ducks (harlequin and long-tailed ducks and white-winged scoter) • Pribilof Islands rock sandpiper is endemic to St. George and St. Paul	Waterfowl present Mar-Nov; migrating birds Mar-May and Sep-Nov, breeding birds May-Aug Steller's eider overwinters Rock sandpiper abundance peaks in Sep Dunlin migration peaks in Oct Black oystercatcher nests during the summer

Species Group	Species Subgroup and Geography	Seasonal Presence
	Other important sites • Urilia Bay is important waterfowl staging area for species including cackling goose and tundra swan • Akutan Harbor is important wintering/staging habitat for Steller's eider (>1,000) birds • Unimak Pass is important to migratory and wintering birds; red and red-necked phalaropes concentrate in the pass • Chagulak Island is one of few islands to have a native population of Aleutian cackling goose • Black oystercatchers nest throughout the Aleutians; form large flocks in protected bays during the winter	
Colonial Nesting Birds	Nesting species include Leach's storm-petrel, fork-tailed storm petrel, tufted puffin, pigeon guillemot, cormorant spp, horned puffin, crested auklet, least auklet, parakeet auklet, whiskered auklet, Cassin's auklet, ancient murrelet, black and red-legged kittiwakes, murre spp., northern fulmar, glaucous-winged gull, and arctic and Aleutian terns *Pribilof Islands* • St. George Island: 2 million seabirds, including >190,000 red-legged kittiwakes (80% of the world's population), ~ 1 million thick-billed murres, auklets common • St. Paul: 180,000 seabirds, including thick-billed murres, auklets, black-legged kittiwakes, and common murres, red-legged kittiwakes (less common than on St. George) • Only islands north of Aleutian chain where red-faced cormorants nest • One of three large colonies of northern fulmars in the E. Bering Sea occurs on St. George *Chagulak Island (>1.5 million seabirds)* • >1 million are Leach's or fork-tailed storm-petrels • Largest northern fulmar colony in Alaska and one of the largest in the world (~500,000) • Largest Cassin's auklet colony in the Aleutians • Significant colonies of tufted puffin, black-legged kittiwake, ancient murrelet, common murre, thick-billed murre • Smaller numbers of pelagic cormorant, double-crested cormorant, red-faced cormorant, red-legged kittiwake, glaucous-winged gull, pigeon guillemot, horned puffin, crested auklet, least auklet, parakeet auklet, whiskered auklet *Akutan Pass/Baby Islands* • ~ 5% of red-faced cormorant population nests in colonies on the west coast of Akutan Island • Mostly tufted puffins and storm-petrels nesting here *Bogoslof and Fire Islands* • >52,000 birds, including murres (26,000), tufted puffins (10,000), and black-legged kittiwakes (4,000) • One of only 6 breeding sites in the world for red legged kittiwakes (412) • Nesters also include pelagic cormorant (30), glaucous-winged gull (872), horned puffin, red-faced cormorant, fork-tailed storm-petrel *Other significant colonies*	Breeding season Apr-Sep Murres present on nest sites Jun-Jul Whispered auklet nests May-Aug, present year round Tufted puffins nest May-Sep

Species Group	Species Subgroup and Geography	Seasonal Presence
	• Amak Island: large concentrations of red-faced and pelagic cormorants, black-legged and red-legged kittiwakes and murres • Kaligagan Island: >125,000 birds, mostly tufted puffins (~110,000), and Leach's and fork-tailed storm-petrels • Aiktak Island: ~ 135,000 birds, including tufted puffins (101,000), and Leach's and fork-tailed storm-petrels • Avatanek Strait Islands: >100K birds combined, mostly tufted puffins (~85,000) • Akutan Harbor: 2% of the global population of tufted puffins nest on North Island (>54,000 nesting seabirds total) • Ogangen Island: 38,000 nesting seabirds, mostly tufted puffins • Emerald Island area: several large colonies are present in Umnak Pass and the southern coast of Unalaska Island, including Emerald Island (162,593), Point Izigan (38,920), Huddle Rocks (22,092), Pustoi Island (29,123) o Fork-tailed and Leach's storm-petrels make up almost 65% of birds, tufted puffins are 28% • Vsevidov (121,000 birds), Kigul (21,000 birds), Ogchul (60,000 birds) Islands: mostly tufted puffins, fork-tailed storm-petrels and Leach's storm-petrels; also black oystercatchers, pigeon guillemots and glaucous-winged gulls • Kagamil Island: >26,000 seabirds, mostly thick-billed and common murres	
Raptors and Passerines	Large population of bald eagles nest on many of the Aleutian Islands Pribilof Islands are a staging site for migrating passerine birds in spring and fall, and hosts some breeding populations during the summer	Bald eagles present year round, nest Mar-Aug
Pinnipeds and sea otters	Two out of six worldwide northern fur seal rookeries occur in the area of impact • Bogoslof Island hosts 13,571 northern fur seals • Pribilof Islands host 56% of the world's population of fur seals (>300,000 seals, most pupping on St. Paul) • Northern fur seals seasonally inhabit the Bering Sea and the Gulf of Alaska and use passes as migratory routes to reach wintering areas further south Steller sea lion (FE) rookeries and haul-outs are located on the Pribilof Islands, Aleutian Islands and Alaskan Peninsula • Highest concentrations (<300) at Bogoslof Island, Akutan Island, Adugak Island, Yunaska Island, Seguam Island • Concentrations of 200-299 can be found on Akun Island, Ogchul Island, Seguam Island • Haul-outs present on most islands and are considered critical habitat Pacific walrus (ESA candidate species) occurs seasonally in the area of the Pribilof Islands and the northern Alaska Peninsula. • Haul-outs on Amak and Walrus Islands are used by mature bulls during spring and summer Northern sea otters (FT) are common in nearshore waters in the Aleutians and Alaskan peninsula. High concentrations can be found in sheltered inlets and bays throughout the area of impact, such as Izemek Lagoon and Beaver Inlet Harbor seals are common • Highest concentrations are found at haul-outs in Akutan Pass • Many sites with <50 individuals present throughout the Aleutians • Sheltered waters of Izembek Lagoon and Beaver Inlet have high concentraitons of harbor seals	Northern fur seal is on rookeries Apr-Nov, pups Jun-Aug Steller sea lions present at haul-outs Apr-Nov pupping May-Jul, molting Jul-Dec, present year round in water Walrus present on haul-outs Apr-Sep, present Mar-Sep, calve Mar-May, molting May-Aug Sea otter pups Apr-May Harbor seal pups Jun-Jul, molt May-Oct, present year round

Species Group	Species Subgroup and Geography	Seasonal Presence
	Spotted seals (FT), bearded seals and ribbon seals occur occasionally in the area	
Whales and dolphins	Coastal species • Harbor porpoise and Dall's porpoise common in coastal areas Bering Sea is foraging grounds for 15 species of whales • Gray whales use Unimak pass as a migration corridor • Blue whale (FE, SE), fin whale (FE), humpback whale (FE, SE), Pacific right whale (FE, SE), sei whale (FE), sperm whale (FE) are all occasional migrants present during the summer • Resident, transient and offshore killer whales present in Bering Sea and Aleutian Islands	Cetaceans present year round Baleen whales present Mar-Dec Killer whale calves Aug-Dec Harbor porpoise calves Jun-Aug
Other Mammals	Brown bears can be found in nearshore waters in the spring and feed on migrating salmon concentrations in coastal streams during the summer	Active spring-fall
Fish & Invertebrates	Dense concentrations of marine organisms occur throughout the Aleutian Islands, including all five species of Pacific salmon, numerous groundfish, herring, crab, shrimp, clams, and a variety of intertidal organisms *Anadromous* • Coho, chinook, pink, sockeye and chum salmon, dolly varden, rainbow trout and cutthroat trout spawn in coastal streams throughout the area of impact *Nearshore/intertidal* • High concentrations of pre-spawning Pacific herring in sheltered waters near eelgrass; spawn on intertidal and subtidal grass/kelp beds and rocks • Sand lance spawn intertidally and subtidally on beaches • High razor clam concentrations found in Izembek lagoon • Bivalve and clam populations high in sheltered bays • Walleye pollock spawning hotspot in SE Bering sea; eggs and larvae are pelagic • Atka mackerel is most valuable groundfish fishery in Aleutians and spawn adhesive eggs in shallow (5-30m) waters *Shelf/offshore* • Major fisheries include king crab, tanner crab, dungeness crab, Alaska plaice, arrowtooth flounder, halibut, Pacific cod, flathead sole, rock sole, sablefish, walleye Pollock, yellowfin sole, Atka mackerel	Salmonids spawning Jul-Jan, eggs present in gravel most of the year (except Jul) Herring spawn Apr-Jul, present nearshore Apr-Sep Invertebrates (clams, chitons) spawning Jun-Jul; larvae present Jul-Dec Sand lance spawn Aug-Oct Pacific herring aggregate Apr-Sep Pollock spawn Feb-May
Benthic Habitats	Eelgrass is common and found in highest density in sheltered bays Diverse and dense aggregations of cold water corals found in Aleutian Islands and provide habitat for a significant percentage of commercially important fish species	Extent greatest during the summer

The Environmental Sensitivity Index (ESI) atlases for the potentially impacted coastal areas from a leak from the *John Straub* are generally available at each U.S. Coast Guard Sector. They can also be downloaded at: http://response.restoration.noaa.gov/esi. These maps show detailed spatial information on the distribution of sensitive shoreline habitats, biological resources, and human-use resources. The tables on the back of the maps provide more detailed life-history information for each species and location. The ESI atlases should be consulted to assess the potential environmental resources at risk for specific spill scenarios. In addition, the Geographic Response Plans within the Area Contingency Plans prepared by the

Area Committee for each U.S. Coast Guard Sector have detailed information on the nearshore and shoreline ecological resources at risk and should be consulted.

Ecological Risk Factors

Risk Factor 3: Impacts to Ecological Resources at Risk (EcoRAR)

Ecological resources include plants and animals (e.g., fish, birds, invertebrates, and mammals), as well as the habitats in which they live. All impact factors are evaluated for both the Worst Case and the Most Probable Discharge oil release from the wreck. Risk factors for ecological resources at risk (EcoRAR) are divided into three categories:

- Impacts to the water column and resources in the water column;
- Impacts to the water surface and resources on the water surface; and
- Impacts to the shoreline and resources on the shoreline.

The impacts from an oil release from the wreck would depend greatly on the direction in which the oil slick moves, which would, in turn, depend on wind direction and currents at the time of and after the oil release. Impacts are characterized in the risk analysis based on the likelihood of any measurable impact, as well as the degree of impact that would be expected if there is an impact. The measure of the degree of impact is based on the median case for which there is at least some impact. The median case is the "middle case" – half of the cases with significant impacts have less impact than this case, and half have more.

For each of the three ecological resources at risk categories, risk is defined as:

- The **probability of oiling** over a certain threshold (i.e., the likelihood that there will be an impact to ecological resources over a certain minimal amount); and
- The **degree of oiling** (the magnitude or amount of that impact).

As a reminder, the ecological impact thresholds are: 1 ppb aromatics for water column impacts; 10 g/m^2 for water surface impacts; and 100 g/m^2 for shoreline impacts.

In the following sections, the definition of low, medium, and high for each ecological risk factor is provided. Also, the classification for the *John Straub* is provided, both as text and as shading of the applicable degree of risk bullet, for the WCD release of 13,000 bbl and a border around the Most Probable Discharge of 1,300 bbl.

Risk Factor 3A: Water Column Impacts to EcoRAR

Water column impacts occur beneath the water surface. The ecological resources at risk for water column impacts are fish, marine mammals, and invertebrates (e.g., shellfish, and small organisms that are food for larger organisms in the food chain). These organisms can be affected by toxic components in the oil. The threshold for water column impact to ecological resources at risk is a dissolved aromatic hydrocarbons concentration of 1 ppb (i.e., 1 part total dissolved aromatics per one billion parts water). Dissolved aromatic hydrocarbons are the most toxic part of the oil. At this concentration and above, one would expect impacts to organisms in the water column.

Risk Factor 3A-1: Water Column Probability of Oiling of EcoRAR

This risk factor reflects the probability that at least 0.2 mi^2 of the upper 33 feet of the water column would be contaminated with a high enough concentration of oil to cause ecological impacts. The three risk scores for water column oiling probability are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

Risk Factor 3A-2: Water Column Degree of Oiling of EcoRAR

The degree of oiling of the water column reflects the total volume of water that would be contaminated by oil at a concentration high enough to cause impacts. The three categories of impact are:

- **Low Impact:** impact on less than 0.2 mi^2 of the upper 33 feet of the water column at the threshold level
- **Medium Impact**: impact on 0.2 to 200 mi^2 of the upper 33 feet of the water column at the threshold level
- **High Impact:** impact on more than 200 mi^2 of the upper 33 feet of the water column at the threshold level

The *John Straub* is classified as Low Risk for oiling probability for water column ecological resources for the WCD of 13,000 bbl because 4% of the model runs resulted in contamination of more than 0.2 mi^2 of the upper 33 feet of the water column above the threshold of 1 ppb aromatics. It is classified as Low Risk for degree of oiling because the mean volume of water contaminated was 0.04 mi^2 of the upper 33 feet of the water column. For the Most Probable Discharge of 1,300 bbl, the *John Straub* is classified as Medium Risk for oiling probability for water column ecological resources because 16% of the model runs resulted in contamination of more than 0.2 mi^2 of the upper 33 feet of the water column above the threshold of 1 ppb aromatics. It is classified as Low Risk for degree of oiling because the mean volume of water contaminated was 0.1 mi^2 of the upper 33 feet of the water column.

Risk Factor 3B: Water Surface Impacts to EcoRAR

Ecological resources at risk at the water surface include surface feeding and diving sea birds, sea turtles, and marine mammals. These organisms can be affected by the toxicity of the oil as well as from coating with oil. The threshold for water surface oiling impact to ecological resources at risk is 10 g/m^2 (10 grams of floating oil per square meter of water surface). At this concentration and above, one would expect impacts to birds and other animals that spend time on the water surface.

Risk Factor 3B-1: Water Surface Probability of Oiling of EcoRAR

This risk factor reflects the probability that at least 1,000 mi^2 of the water surface would be affected by enough oil to cause impacts to ecological resources. The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%

- **High Oiling Probability:** Probability > 50%

Risk Factor 3B-2: Water Surface Degree of Oiling of EcoRAR

The degree of oiling of the water surface reflects the total amount of oil that would affect the water surface in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** less than 1,000 mi^2 of water surface impact at the threshold level
- **Medium Impact:** 1,000 to 10,000 mi^2 of water surface impact at the threshold level
- **High Impact:** more than 10,000 mi^2 of water surface impact at the threshold level

The *John Straub* is classified as High Risk for oiling probability for water surface ecological resources for the WCD because 76% of the model runs resulted in at least 1,000 mi^2 of the water surface affected above the threshold of 10 g/m^2. It is classified as Medium Risk for degree of oiling because the mean area of water contaminated was 3,320 mi^2. The *John Straub* is classified as Medium Risk for oiling probability for water surface ecological resources for the Most Probable Discharge because 38% of the model runs resulted in at least 1,000 mi^2 of the water surface affected above the threshold of 10 g/m^2. It is classified as Low Risk for degree of oiling because the mean area of water contaminated was 860 mi^2.

Risk Factor 3C: Shoreline Impacts to EcoRAR

The impacts to different types of shorelines vary based on their type and the organisms that live on them. In this risk analysis, shorelines have been weighted by their degree of sensitivity to oiling. Wetlands are the most sensitive (weighted as "3" in the impact modeling), rocky and gravel shores are moderately sensitive (weighted as "2"), and sand beaches (weighted as "1") are the least sensitive to ecological impacts of oil.

Risk Factor 3C-1: Shoreline Probability of Oiling of EcoRAR

This risk factor reflects the probability that the shoreline would be coated by enough oil to cause impacts to shoreline organisms. The threshold for shoreline oiling impacts to ecological resources at risk is 100 g/m^2 (i.e., 100 grams of oil per square meter of shoreline). The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

Risk Factor 3C-2: Shoreline Degree of Oiling of EcoRAR

The degree of oiling of the shoreline reflects the length of shorelines oiled by at least 100 g/m^2 in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** less than 10 miles of shoreline impacted at the threshold level
- **Medium Impact:** 10 - 100 miles of shoreline impacted at the threshold level
- **High Impact:** more than 100 miles of shoreline impacted at the threshold level

The *John Straub* is classified as High Risk for oiling probability for shoreline ecological resources for the WCD because 83% of the model runs resulted in shorelines affected above the threshold of 100 g/m^2. It is classified as Medium Risk for degree of oiling because the mean weighted length of shoreline contaminated was 45 miles. The *John Straub* is classified as High Risk for oiling probability to shoreline ecological resources for the Most Probable Discharge because 73% of the model runs resulted in shorelines affected above the threshold of 100 g/m^2. It is classified as Medium Risk for degree of oiling because the mean weighted length of shoreline contaminated was 11 miles.

Considering the modeled risk scores and the ecological resources at risk, the ecological risk from potential releases of the WCD of 13,000 bbl of heavy fuel oil from the *John Straub* is summarized as listed below and indicated in the far-right column in Table 3-2:

- Water column resources – Low, because little-to-no water column impacts are likely
- Water surface resources – High, because there can be very large number of wintering, nesting, and migratory birds that use ocean, coastal, and estuarine habitats at risk at risk of exposure to persistent tarballs. It should be noted that oil on the surface will not be continuous but rather be broken and patchy and in the form of sheens, tarballs, and streamers
- Shoreline resources – Medium, because of the extent of potential shoreline oiling along shorelines with very difficult access, though most of the shorelines at risk are high energy shorelines where oil persistence is likely to be short

Table 3-2: Ecological risk factor scores for the **Worst Case Discharge of 13,000 bbl** of heavy fuel oil from the *John Straub*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
3A-1: Water Column Probability EcoRAR Oiling	**Low**	**Medium**	**High**	4% of the model runs resulted in at least 0.2 mi^2 of the upper 33 feet of the water column contaminated above 1 ppb aromatics	**Low**
3A-2: Water Column Degree EcoRAR Oiling	**Low**	**Medium**	**High**	The mean volume of water contaminated above 1 ppb was 0.04 mi^2 of the upper 33 feet of the water column	
3B-1: Water Surface Probability EcoRAR Oiling	**Low**	**Medium**	**High**	76% of the model runs resulted in at least 1,000 mi^2 of water surface covered by at least 10 g/m^2	**High**
3B-2: Water Surface Degree EcoRAR Oiling	**Low**	**Medium**	**High**	The mean area of water contaminated above 10 g/m^2 was 3,320 mi^2	
3C-1: Shoreline Probability EcoRAR Oiling	**Low**	**Medium**	**High**	83% of the model runs resulted in shoreline oiling of 100 g/m^2	**Med**
3C-2: Shoreline Degree EcoRAR Oiling	**Low**	**Medium**	**High**	The length of shoreline contaminated by at least 100 g/m^2 was 45 mi	

For the Most Probable Discharge of 1,300 bbl, the ecological risk from potential releases from the *John Straub* is summarized as listed below and indicated in the far-right column in Table 3-3:

- Water column resources – Low, because little-to-no water column impacts are likely
- Water surface resources – High, because there can be very large number of wintering, nesting, and migratory birds that use ocean, coastal, and estuarine habitats at risk at risk of exposure to persistent tarballs. It should be noted that oil on the surface will not be continuous but rather be broken and patchy and in the form of sheens, tarballs, and streamers
- Shoreline resources – Low, because of the small amount of potential shoreline oiling along high-energy coasts

Table 3-3: Ecological risk factor scores for the **Most Probable Discharge of 1,300 bbl** of heavy fuel oil from the *John Straub*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
3A-1: Water Column Probability EcoRAR Oiling	Low	Medium	High	16% of the model runs resulted in at least 0.2 mi^2 of the upper 33 feet of the water column contaminated above 1 ppb aromatics	Low
3A-2: Water Column Degree EcoRAR Oiling	Low	Medium	High	The mean volume of water contaminated above 1 ppb was 0.1 mi^2 of the upper 33 feet of the water column	
3B-1: Water Surface Probability EcoRAR Oiling	Low	Medium	High	38% of the model runs resulted in at least 1,000 mi^2 of water surface covered by at least 10 g/m^2	High
3B-2: Water Surface Degree EcoRAR Oiling	Low	Medium	High	The mean area of water contaminated above 10 g/m^2 was 860 mi^2	
3C-1: Shoreline Probability EcoRAR Oiling	Low	Medium	High	73% of the model runs resulted in shoreline oiling of 100 g/m^2	Low
3C-2: Shoreline Degree EcoRAR Oiling	Low	Medium	High	The length of shoreline contaminated by at least 100 g/m^2 was 11 mi	

SECTION 4: SOCIO-ECONOMIC RESOURCES AT RISK

In addition to natural resource impacts, spills from sunken wrecks have the potential to cause significant social and economic impacts. Socio-economic resources potentially at risk from oiling are listed in Table 4-1 and shown in Figures 4-1 and 4-2. The potential economic impacts include disruption of coastal economic activities such as commercial and recreational fishing, boating, vacationing, commercial shipping, and other activities that may become claims following a spill.

Socio-economic resources in the areas potentially affected by a release from the *John Straub* include a large number of Alaskan native villages whose inhabitants are largely dependent on subsistence fishing and use their lands and surrounding waters for cultural activities. The area also has a significant commercial fishing industry totaling at least $250 million annually.

There are also sensitive national wildlife refuges that cover most of the area of impact.

In addition to the ESI atlases, the Geographic Response Plans within the Area Contingency Plans prepared by the Area Committee for each U.S. Coast Guard Sector have detailed information on important socio-economic resources at risk and should be consulted.

Spill response costs for a release of oil from the *John Straub* would be dependent on volume of oil released and specific areas impacted. The specific shoreline impacts and spread of the oil would determine the response required and the costs for that response.

Table 4-1: Socio-economic resources at risk from a release of oil from the *John Straub*.

Resource Type	Resource Name	Economic Activities
Coastal Communities	Cold Bay Dutch Harbor-Unalaska Fort Glenn	Potentially affected coastal communities in the Aleutian Islands could be impacted. While these communities are generally not tourist destinations, oiling of the coastal areas would impact the lives of community inhabitants.
National Wildlife Refuges	Alaska Maritime NWR Alaska Peninsula NWR Izembek NWR	National wildlife refuges may be impacted. These federally managed and protected lands provide refuges and conservation areas for sensitive species and habitats.
National Park	Dutch Harbor Naval Operating Base/Fort Mears National Historic Site	National historic sites protect our nation's history and provide recreational activities for residents and visitors.
Tribal Lands	Akutan Atka Belkofski False Pass (Isanak) Ivanof Bay King Cove (Agdaagux) Nikolski Sanak (Sanagax) Unalaska (Iluulux)	The Aleutian islands are home to a number of native tribes who are generally dependent on subsistence fishing.

Resource Type	Resource Name	Economic Activities
Commercial Fishing	A number of fishing fleets use the area around the Aleutians for commercial fishing purposes	
	Akutan	Total Landings (2010): $84.1M
	Unalaska-Dutch Harbor	Total Landings (2010): $163.1M
	Atka	Total Landings (2010): unknown

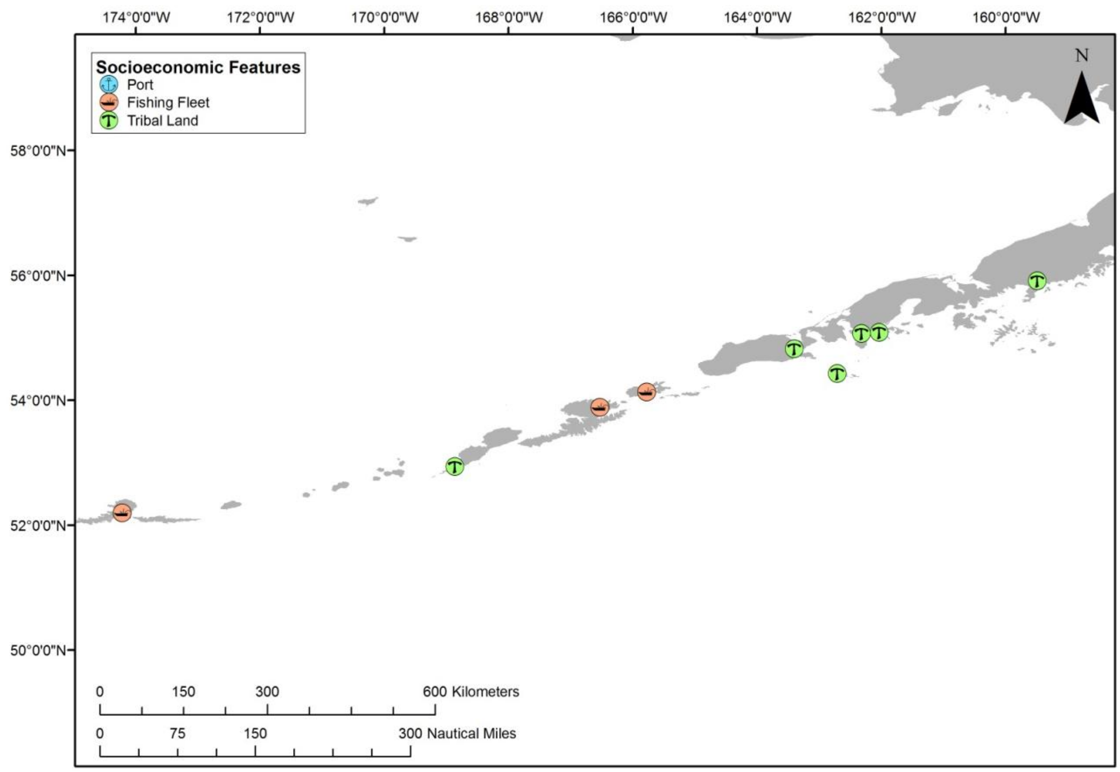

Figure 4-1: Tribal lands, ports, and commercial fishing fleets at risk from a release from the *John Straub*.

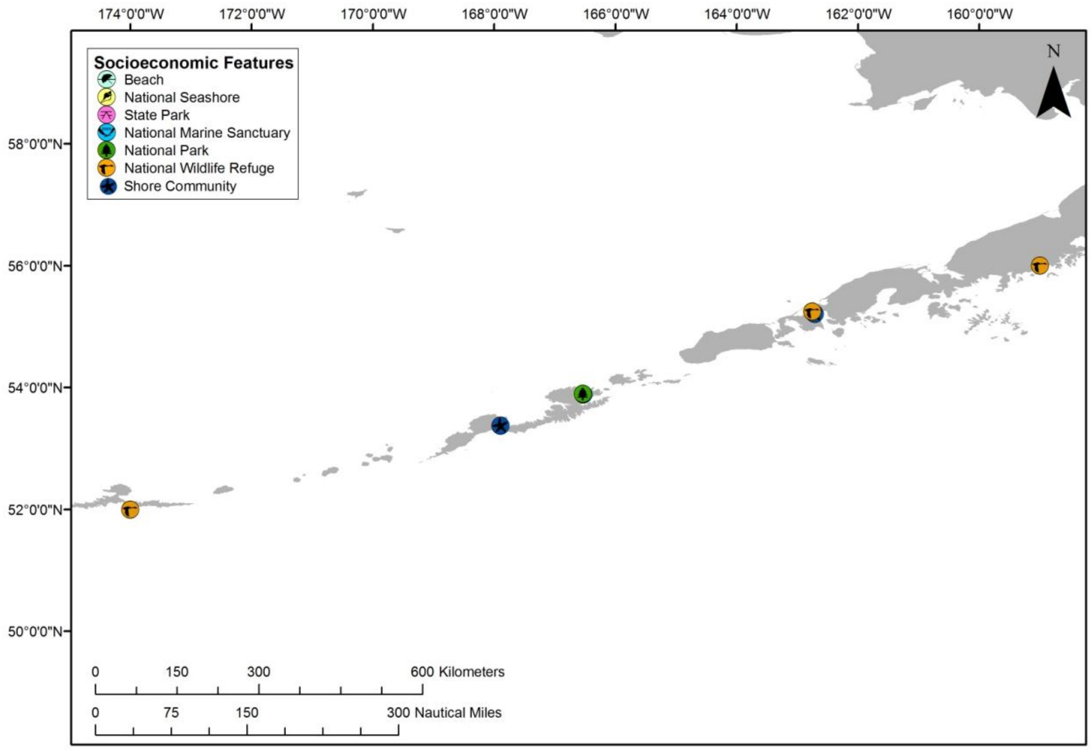

Figure 4-2: Beaches, coastal state parks, and Federal protected areas at risk from a release from the *John Straub*.

Socio-Economic Risk Factors

Risk Factor 4: Impacts to Socio-economic Resources at Risk (SRAR)

Socio-economic resources at risk (SRAR) include potentially impacted resources that have some economic value, including commercial and recreational fishing, tourist beaches, private property, etc. All impact factors are evaluated for both the Worst Case and the Most Probable Discharge oil release from the wreck. Risk factors for socio-economic resources at risk are divided into three categories:

- **Water Column:** Impacts to the water column and to economic resources in the water column (i.e., fish and invertebrates that have economic value);
- **Water Surface:** Impacts to the water surface and resources on the water surface (i.e., boating and commercial fishing); and
- **Shoreline:** Impacts to the shoreline and resources on the shoreline (i.e., beaches, real property).

The impacts from an oil release from the wreck would depend greatly on the direction in which the oil slick moves, which would, in turn, depend on wind direction and currents at the time of and after the oil release. Impacts are characterized in the risk analysis based on the likelihood of any measurable impact, as well as the degree of impact that would be expected if there is to be any impact. The measure of the degree of impact is based on the median case for which there is at least some impact. The median case is the “middle case” – half of the cases for which there are significant impacts have less impact than this case, and half have more.

For each of the three socio-economic resources at risk categories, risk is classified with regard to:

- The **probability of oiling** over a certain threshold (i.e., the likelihood that there will be exposure to socio-economic resources over a certain minimal amount known to cause impacts); and
- The **degree of oiling** (the magnitude or amount of that exposure over the threshold known to cause impacts).

As a reminder, the socio-economic impact thresholds are: 1 ppb aromatics for water column impacts; 0.01 g/m^2 for water surface impacts; and 1 g/m^2 for shoreline impacts.

In the following sections, the definition of low, medium, and high for each socio-economic risk factor is provided. Also, in the text classification for the *John Straub*, shading indicates the degree of risk for a WCD release of 13,000 bbl and a border indicates degree of risk for the Most Probable Discharge of 1,300 bbl.

Risk Factor 4A-1: Water Column: Probability of Oiling of SRAR

This risk factor reflects the probability that at least 0.2 mi^2 of the upper 33 feet of the water column would be contaminated with a high enough concentration of oil to cause socio-economic impacts. The threshold for water column impact to socio-economic resources at risk is an oil concentration of 1 ppb (i.e., 1 part oil per one billion parts water). At this concentration and above, one would expect impacts and potential tainting to socio-economic resources (e.g., fish and shellfish) in the water column; this concentration is used as a screening threshold for both the ecological and socio-economic risk factors.
The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

Risk Factor 4A-2: Water Column Degree of Oiling of SRAR

The degree of oiling of the water column reflects the total amount of oil that would affect the water column in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** impact on less than 0.2 mi^2 of the upper 33 feet of the water column at the threshold level
- **Medium Impact:** impact on 0.2 to 200 mi^2 of the upper 33 feet of the water column at the threshold level
- **High Impact:** impact on more than 200 mi^2 of the upper 33 feet of the water column at the threshold level

The *John Straub* is classified as Low Risk for both oiling probability and degree of oiling for water column socio-economic resources for the WCD of 13,000 bbl because 4% of the model runs resulted in contamination of more than 0.2 mi^2 of the upper 33 feet of the water column above the threshold of 1 ppb aromatics, and the mean volume of water contaminated was 0.04 mi^2 of the upper 33 feet of the water column. For the Most Probable Discharge of 1,300 bbl, the *John Straub* is classified as Medium Risk for oiling probability for water column socio-economic resources because 16% of the model runs resulted in contamination of more than 0.2 mi^2 of the upper 33 feet of the water column above the threshold of 1 ppb aromatics. It is classified as Low Risk for degree of oiling because the mean volume of water contaminated was 0.1 mi^2 of the upper 33 feet of the water column.

Risk Factor 4B-1: Water Surface Probability of Oiling of SRAR

This risk factor reflects the probability that at least 1,000 mi^2 of the water surface would be affected by enough oil to cause impacts to socio-economic resources. The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

The threshold level for water surface impacts to socio-economic resources at risk is 0.01 g/m^2 (i.e., 0.01 grams of floating oil per square meter of water surface). At this concentration and above, one would expect impacts to socio-economic resources on the water surface.

Risk Factor 4B-2: Water Surface Degree of Oiling of SRAR

The degree of oiling of the water surface reflects the total amount of oil that would affect the water surface in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** less than 1,000 mi^2 of water surface impact at the threshold level
- **Medium Impact:** 1,000 to 10,000 mi^2 of water surface impact at the threshold level
- **High Impact:** more than 10,000 mi^2 of water surface impact at the threshold level

The *John Straub* is classified as High Risk for oiling probability and Medium Risk for degree of oiling for water surface socio-economic resources for the WCD because 76% of the model runs resulted in at least 1,000 mi^2 of the water surface affected above the threshold of 0.01 g/m^2, and the mean area of water contaminated was 3,300 mi^2. The *John Straub* is classified as Medium Risk for oiling probability for water surface socio-economic resources for the Most Probable Discharge because 38% of the model runs resulted in at least 1,000 mi^2 of the water surface affected above the threshold of 0.01 g/m^2. It is classified as Low Risk for degree of oiling because the mean area of water contaminated was 860 mi^2.

Risk Factor 4C: Shoreline Impacts to SRAR

The impacts to different types of shorelines vary based on economic value. In this risk analysis, shorelines have been weighted by their degree of sensitivity to oiling. Sand beaches are the most economically valued shorelines (weighted as “3” in the impact analysis), rocky and gravel shores are moderately valued (weighted as “2”), and wetlands are the least economically valued shorelines (weighted as “1”). Note that these values differ from the ecological values of these three shoreline types.

Risk Factor 4C-1: Shoreline Probability of Oiling of SRAR

This risk factor reflects the probability that the shoreline would be coated by enough oil to cause impacts to shoreline users. The threshold for impacts to shoreline SRAR is 1 g/m^2 (i.e., 1 gram of oil per square meter of shoreline). The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

Risk Factor 4C-2: Shoreline Degree of Oiling of SRAR

The degree of oiling of the shoreline reflects the total amount of oil that would affect the shoreline in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** less than 10 miles of shoreline impacted at threshold level
- **Medium Impact:** 10 - 100 miles of shoreline impacted at threshold level
- **High Impact:** more than 100 miles of shoreline impacted at threshold level

The *John Straub* is classified as High Risk for oiling probability for shoreline socio-economic resources for the WCD because 84% of the model runs resulted in shorelines affected above the threshold of 1 g/m^2. It is classified as High Risk for degree of oiling because the mean length of weighted shoreline contaminated was 100 miles. The *John Straub* is classified as High Risk for oiling probability and Medium Risk for degree of oiling for shoreline socio-economic resources for the Most Probable Discharge as 83% of the model runs resulted in shorelines affected above the threshold of 1 g/m^2, and the mean length of weighted shoreline contaminated was 74 miles.

Considering the modeled risk scores and the socio-economic resources at risk, the socio-economic risk from potential releases of the WCD of 13,000 bbl of heavy fuel oil from the *John Straub* is summarized as listed below and indicated in the far-right column in Table 4-2:

- Water column resources – Low, because although there are very sensitive fishing grounds in the area, the total area of water column impact is very small
- Water surface resources – High, because a moderate area of water surface impact would occur in highly sensitive tribal areas, fishing grounds, and wildlife refuges. It should be noted that oil on the surface will not be continuous but rather be broken and patchy and in the form of sheens, tarballs, and streamers
- Shoreline resources – High, because a significant length of shoreline would be impacted in sensitive tribal areas and wildlife refuges

Table 4-2: Socio-economic risk factor ranks for the **Worst Case Discharge of 13,000 bbl** of heavy fuel oil from the *John Straub*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
4A-1: Water Column Probability SRAR Oiling	**Low**	Medium	High	4% of the model runs resulted in at least 0.2 mi^2 of the upper 33 feet of the water column contaminated above 1 ppb aromatics	**Low**
4A-2: Water Column Degree SRAR Oiling	**Low**	Medium	High	The mean volume of water contaminated above 1 ppb was 0.04 mi^2 of the upper 33 feet of the water column	
4B-1: Water Surface Probability SRAR Oiling	Low	Medium	**High**	76% of the model runs resulted in at least 1,000 mi^2 of water surface covered by at least 0.01 g/m^2	**High**
4B-2: Water Surface Degree SRAR Oiling	Low	**Medium**	High	The mean area of water contaminated above 0.01 g/m^2 was 3,300 mi^2	
4C-1: Shoreline Probability SRAR Oiling	Low	Medium	**High**	84% of the model runs resulted in shoreline oiling of 1 g/m^2	**High**
4C-2: Shoreline Degree SRAR Oiling	Low	Medium	**High**	The length of shoreline contaminated by at least 1 g/m^2 was 100 mi	

For the Most Probable Discharge of 1,300 bbl, the socio-economic risk from potential releases of heavy fuel oil from the *John Straub* is summarized as listed below and indicated in the far-right column in Table 4-3:

- Water column resources – Low, because although there are very sensitive fishing grounds in the area, the total area of water column impact is very small
- Water surface resources – Medium, because relatively small area of water surface impact would occur in highly sensitive tribal areas, fishing grounds, and wildlife refuges. It should be noted that oil on the surface will not be continuous but rather be broken and patchy and in the form of sheens, tarballs, and streamers
- Shoreline resources – High, because a significant length of shoreline would be impacted in sensitive tribal areas and wildlife refuges

Table 4-3: Socio-economic risk factor ranks for the **Most Probable Discharge of 1,300 bbl** of heavy fuel oil from the *John Straub*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
4A-1: Water Column Probability SRAR Oiling	Low	**Medium**	High	16% of the model runs resulted in at least 0.2 mi^2 of the upper 33 feet of the water column contaminated above 1 ppb aromatics	Low
4A-2: Water Column Degree SRAR Oiling	**Low**	Medium	High	The mean volume of water contaminated above 1 ppb was 0.1 mi^2 of the upper 33 feet of the water column	
4B-1: Water Surface Probability SRAR Oiling	Low	**Medium**	High	38% of the model runs resulted in at least 1,000 mi^2 of water surface covered by at least 0.01 g/m^2	Med
4B-2: Water Surface Degree SRAR Oiling	**Low**	Medium	High	The mean area of water contaminated above 0.01 g/m^2 was 860 mi^2	
4C-1: Shoreline Probability SRAR Oiling	Low	Medium	**High**	83% of the model runs resulted in shoreline oiling of 1 g/m^2	High
4C-2: Shoreline Degree SRAR Oiling	Low	**Medium**	High	The length of shoreline contaminated by at least 1 g/m^2 was 74 mi	

SECTION 5: OVERALL RISK ASSESSMENT AND RECOMMENDATIONS FOR ASSESSMENT, MONITORING, OR REMEDIATION

The overall risk assessment for the *John Straub* is comprised of a compilation of several components that reflect the best available knowledge about this particular site. Those components are reflected in the previous sections of this document and are:

- Vessel casualty information and how the site formation processes have worked on this particular vessel
- Ecological resources at risk
- Socio-economic resources at risk
- Other complicating factors (war graves, other hazardous cargo, etc.)

Table 5-1 summarizes the screening-level risk assessment scores for the different risk factors, as discussed in the previous sections. The ecological and socio-economic risk factors are presented as a single score for water column, water surface, and shoreline resources as the scores were consolidated for each element. For the ecological and socio-economic risk factors each has two components, probability and degree. Of those two, degree is given more weight in deciding the combined score for an individual factor, e.g., a high probability and medium degree score would result in a medium overall for that factor.

In order to make the scoring more uniform and replicable between wrecks, a value was assigned to each of the 7 criteria. This assessment has a total of 7 criteria (based on table 5-1) with 3 possible scores for each criteria (L, M, H). Each was assigned a point value of L=1, M=2, H=3. The total possible score is 21 points, and the minimum score is 7. The resulting category summaries are:

Low Priority	7-11
Medium Priority	12-14
High Priority	15-21

For the Worst Case Discharge, the *John Straub* scores High with 15 points; for the Most Probable Discharge, the *John Straub* scores Medium with 13 points. Under the National Contingency Plan, the U.S. Coast Guard and the Regional Response Team have the primary authority and responsibility to plan, prepare for, and respond to oil spills in U.S. waters. Based on the technical review of available information, NOAA proposes the following recommendations for the *John Straub*. The final determination rests with the U.S. Coast Guard.

John Straub	Possible NOAA Recommendations
	Wreck should be considered for further assessment to determine the vessel condition, amount of oil onboard, and feasibility of oil removal action
✓	Location is unknown; Use surveys of opportunity to attempt to locate this vessel and gather more information on the vessel condition
	Conduct active monitoring to look for releases or changes in rates of releases
✓	Be noted in the Area Contingency Plans so that if a mystery spill is reported in the general area, this vessel could be investigated as a source
✓	Conduct outreach efforts with the technical and recreational dive community as well as commercial and recreational fishermen who frequent the area, to gain awareness of changes in the site

Table 5-1: Summary of risk factors for the *John Straub*.

Vessel Risk Factors		Data Quality Score	Comments		Risk Score
Pollution Potential Factors	A1: Oil Volume (total bbl)	Medium	Maximum of 12,054 bbl, not reported to be leaking		**Med**
	A2: Oil Type	High	Bunker fuel is a heavy fuel oil, a Group IV oil type		
	B: Wreck Clearance	High	Vessel not reported as cleared		
	C1: Burning of the Ship	High	Fire was reported		
	C2: Oil on Water	High	Oil was reported on the water; amount is not known		
	D1: Nature of Casualty	High	Multiple explosions		
	D2: Structural Breakup	High	The vessel broke in two at the time of sinking		
Archaeological Assessment	Archaeological Assessment	High	Detailed sinking records and photographs of this ship exist, assessment is believed to be very accurate		**Not Scored**
Operational Factors	Wreck Orientation	Low	Unknown		**Not Scored**
	Depth	Low	~ 200 ft		
	Visual or Remote Sensing Confirmation of Site Condition	Low	Location unknown		
	Other Hazardous Materials Onboard	High	Explosives		
	Munitions Onboard	High	Munitions for onboard weapons		
	Gravesite (Civilian/Military)	High	No		
	Historical Protection Eligibility (NHPA/SMCA)	High	NHPA and SMCA		
				WCD	**Most Probable**
Ecological Resources	3A: Water Column Resources	High	Very small areas of potential impact to the water column	**Low**	**Low**
	3B: Water Surface Resources	High	Seasonally very high concentrations of marine birds and mammals present, persistent tarballs would pose significant risks	**High**	**High**
	3C: Shore Resources	High	Most shoreline oiling likely along high-energy and very difficult access areas	**Med**	**Low**
Socio-Economic Resources	4A: Water Column Resources	High	Although there are very sensitive fishing grounds in the area, the total area of water column impact is very small	**Low**	**Low**
	4B: Water Surface Resources	High	Moderate area of water surface impact in highly sensitive tribal areas, fishing grounds, and wildlife refuges	**High**	**Med**
	4C: Shore Resources	High	Significant length of shoreline could be impacted in sensitive tribal areas and wildlife refuges	**High**	**High**
Summary Risk Scores				**15**	**13**