Office of National Marine Sanctuaries
Office of Response and Restoration

Screening Level Risk Assessment Package

Juan Casiano

March 2013

National Oceanic and
Atmospheric Administration

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Photo: Photograph of *Juan Casiano* under its former name *Linerton*
Source: http://www.photoship.co.uk/JAlbum%20Ships/Old%20Ships%20L/slides/Linerton-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.

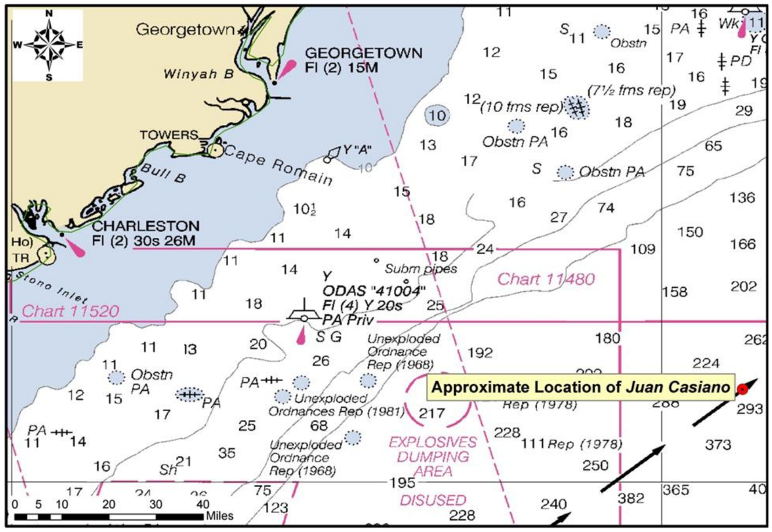
In order to narrow down the potential sites for inclusion into regional and area contingency plans, in 2010, Congress appropriated $1 million to identify the most ecologically and economically significant potentially polluting wrecks in U.S. waters. This project supports the U.S. Coast Guard and the 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: *Juan Casiano*



The tanker *Juan Casiano*, lost in a storm off the coast of South Carolina 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 *Juan Casiano*, 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, *Juan Casiano* scores High with 15 points; for the Most Probable Discharge (10% of the Worse Case volume), *Juan Casiano* scores Medium with 12 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 the low level of data certainty, and 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 dive community as well as commercial 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)	High	
	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	Med
	3C: Shore Resources	Med	Low
Socio-Economic Resources	4A: Water Column Resources	Low	Low
	4B: Water Surface Resources	High	Med
	4C: Shore Resources	Med	Med
Summary Risk Scores		15	12

The determination of each risk factor is explained in the document. This summary table is found on page 38.

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

Vessel Particulars

Official Name: *Juan Casiano*

Official Number: Unknown

Vessel Type: Tanker

Vessel Class: Unknown

Former Names: *Tine Asmussen*; *Radix*; *Linerton*

Year Built: 1919

Builder: William Doxford & Sons, Ltd., Sunderland

Builder's Hull Number: Unknown

Flag: Mexican

Owner at Loss: Petroleos Mexicanos S.A.

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

Operated by: Unknown

Homeport: Coatzacoalcos, Mexico

Length: 412 feet **Beam:** 55 feet **Depth:** 34 feet

Gross Tonnage: 7,064 **Net Tonnage:** 5,117

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

Bunker Type: Heavy fuel oil (Bunker C) **Bunker Capacity (bbl):** 6,630

Average Bunker Consumption (bbl) per 24 hours: 281

Liquid Cargo Capacity (bbl): 67,000 **Dry Cargo Capacity:** Unknown

Tank or Hold Description: Unknown

Casualty Information

Port Departed: Unknown

Destination Port: Unknown

Date Departed: Unknown

Date Lost: October 19, 1944

Number of Days Sailing: Unknown

Cause of Sinking: Storm

Latitude (DD): 32.28354

Longitude (DD): -77.74969

Nautical Miles to Shore: 94

Nautical Miles to NMS: 192

Nautical Miles to MPA: 0

Nautical Miles to Fisheries: Unknown

Approximate Water Depth (Ft): 1,730

Bottom Type: Sand

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

Wreck Orientation: Unknown

Vessel Armament: Unknown

Cargo Carried when Lost: Unknown

Cargo Oil Carried (bbl): Unknown

Cargo Oil Type: Unknown

Probable Fuel Oil Remaining (bbl): ≤ 6,630

Fuel Type: Heavy fuel oil (Bunker C)

Total Oil Carried (bbl): ≤ 6,630

Dangerous Cargo or Munitions: Unknown

Munitions Carried: Unknown

Demolished after Sinking: No

Salvaged: No

Cargo Lost: Yes

Reportedly Leaking: No

Historically Significant: Unknown

Gravesite: Yes

Salvage Owner: Not known if any

Wreck Location

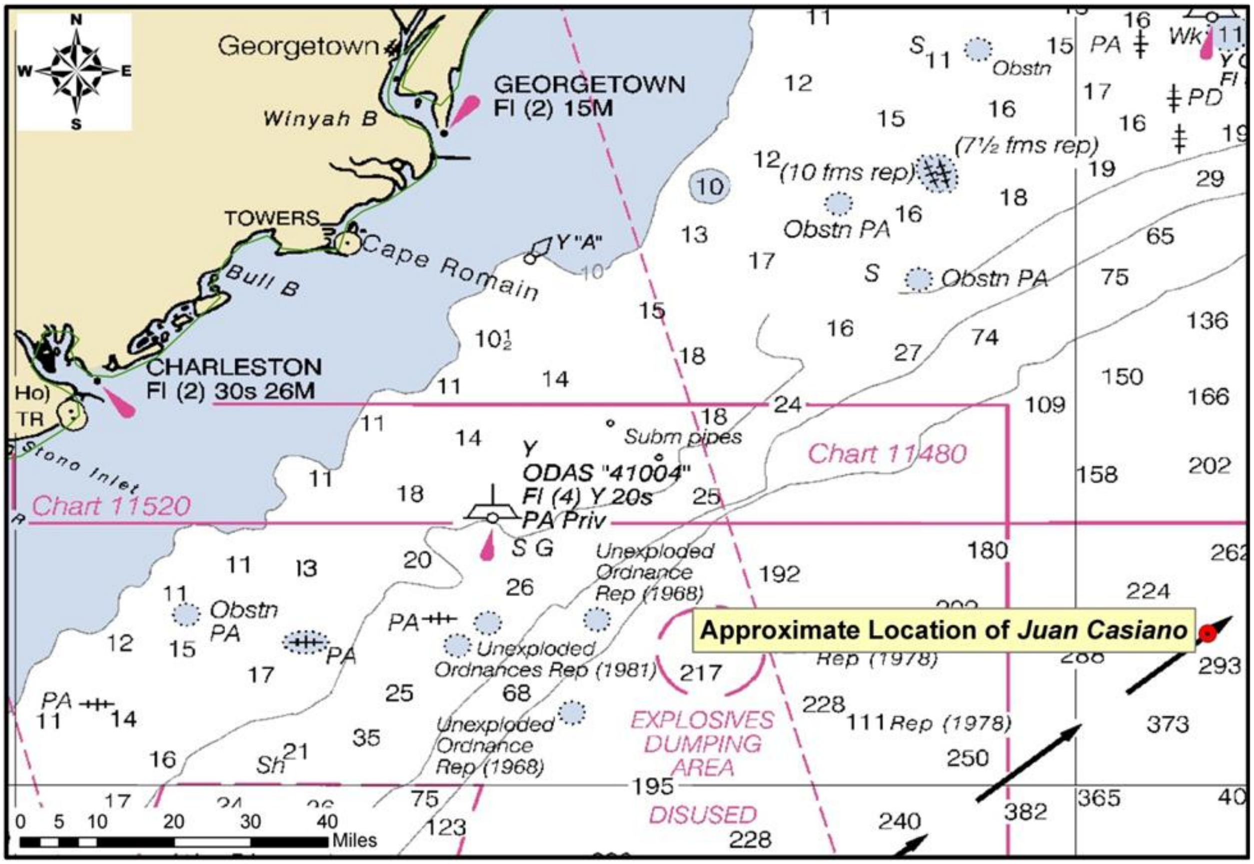


Chart Number: 411

Casualty Narrative

The vessel was lost in a collision (now believed to be a storm since no other vessel appears to have been involved) off the coast of South Carolina.

General Notes

AWOIS Data:
DESCRIPTION
NO.1408; TANKER, 7064 GT; SUNK 10/19/44 BY MARINE CASUALTY; POSITION ACCURACY 3-5 MILES.

SURVEY REQUIREMENTS NOT DETERMINED.

Wreck Condition/Salvage History

Unknown; 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

Unfortunately, there is little historic documentation on the sinking of the tanker *Juan Casiano*, and no site reports exist that would allow NOAA archaeologists to provide much additional archaeological assessment about the shipwreck on top of the casualty narrative included in this packet. Inaccuracy in the reported sinking location (in the case of *Juan Casiano*, NOAA archaeologists have only located newspaper articles) of this wreck also prevents a thorough analysis. The ship was initially reported to have been lost in a collision (official reports state that it broke up in a storm since no other vessel was involved) 90 miles off the Georgia coast. Based on the large degree of inaccuracy in the reported sinking location and the ocean depths 90 miles east of Georgia, it is unlikely that the shipwreck will be intentionally located.

Ongoing research also strongly suggests that vessels in great depths of water are generally found in an upright orientation. This orientation has often lead to loss of oil from vents and piping long before loss of structural integrity of hull plates from corrosion or other physical impacts. As it is believed that this vessel is in water greater than 1,500 feet, it is likely to have settled upright and may no longer contain oil.

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 may be of historic significance and will require appropriate actions be taken under the National Historic Preservation Act (NHPA) 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. The site is also considered a gravesite and appropriate actions should be undertaken to minimize disturbance to the site.

Background Information References

Vessel Image Sources:
http://www.photoship.co.uk/JAlbum%20Ships/Old%20Ships%20L/slides/Linerton-01.html (photograph of the vessel under it former name *Linerton*)

Construction Diagrams or Plans in RULET Database? No

Text References:

-United States Coast Guard
WW II Reports Concerning Merchant Vessels Sinking, 1938-2002, Foreign, Jeypore to Linden Hall, Records of the United States Coast Guard, Entry P-2, Box 65, Record Group 26, National Archives Building, Washington, DC.

-AWOIS database;

http://news.google.com/newspapers?nid=1338&dat=19441102&id=3uJXAAAAIBAJ&sjid=bfUDAAAAIBAJ&pg=4832,271890

http://news.google.com/newspapers?nid=950&dat=19441024&id=2PRPAAAAIBAJ&sjid=HFUDAAAAIBAJ&pg=2226,1246178

Vessel Risk Factors

In this section, the risk factors that are associated with the vessel are defined and then applied to the *Juan Casiano* 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 1-1 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.

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 1-1.

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.

Pollution Potential Tree

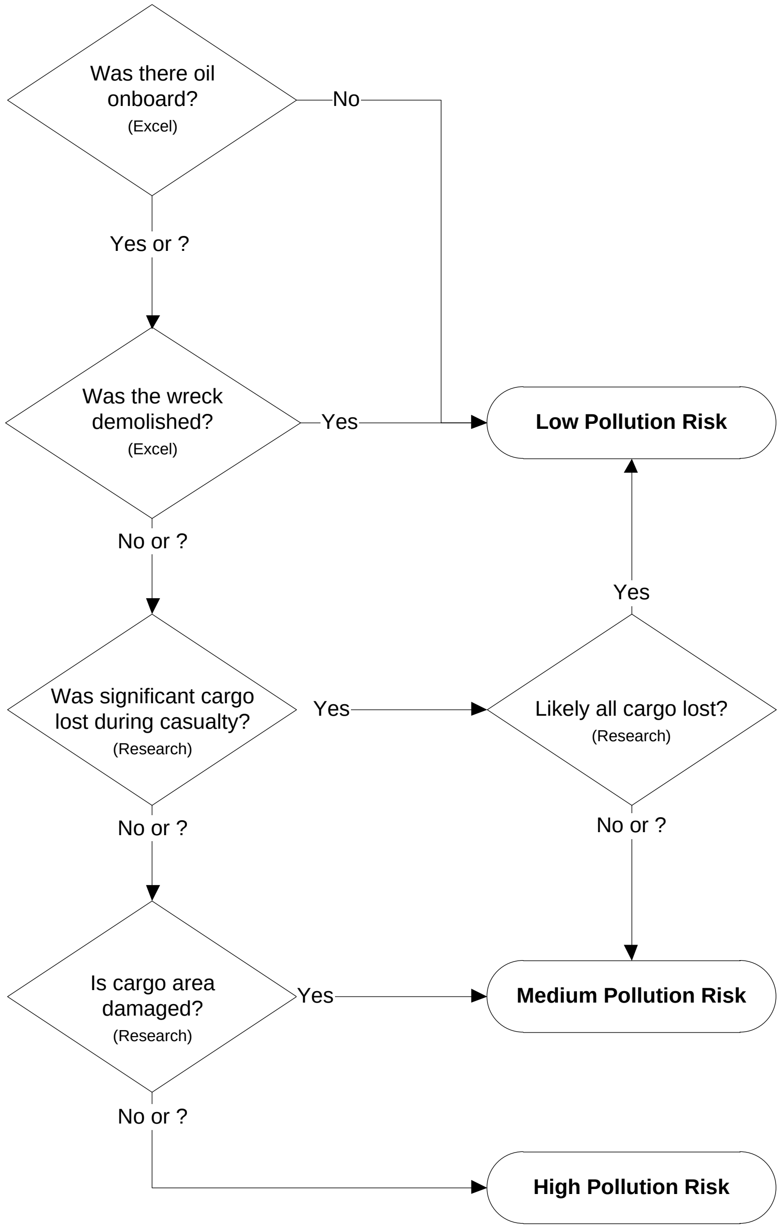


Figure 1-1: U.S. Coast Guard Salvage Engineering Response Team (SERT) developed the above Pollution Potential Decision Tree.

- **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 *Juan Casiano* 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 *Juan Casiano* is ranked as High Volume because it is thought to have a potential for at least 6,630 bbl. Data quality is low because it is not known if the tanker was carrying a cargo of oil when lost and the volume potential is only based on the vessel's bunker capacity.

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 *Juan Casiano*.

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 *Juan Casiano* is classified as High Risk because the bunker oil is heavy fuel oil, a Group IV oil type. Data quality is low because it is not known whether the vessel carried cargo oil in addition to bunker fuel.

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

[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]

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

The *Juan Casiano* is classified as High Risk because there is no known report of fire at the time of the 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 know whether or not there was oil on the water at the time of the casualty

The *Juan Casiano* is classified as High Risk because no oil is known to have been reported spreading across the water as the vessel went down. Data quality is low because complete sinking reports were not located.

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 *Juan Casiano* is classified as High Risk because the vessel sank in a storm. 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 *Juan Casiano* is classified as Unknown Risk because it is not known whether additional structural breakup occurred after the vessel sank because the location is not known. Data quality is low.

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 *Juan Casiano* 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 *Juan Casiano* is believed to be over 1,700 feet deep based on the reported sinking 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 *Juan Casiano* 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.

It is not known if the *Juan Casiano* carried additional hazardous materials since complete sinking reports were not located. Data quality is low.

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.

It is not known if the *Juan Casiano* carried munitions or weapons at the time of its loss. It is possible it was equipped with weapons since it sank during WWII, but this may not be the case since the vessel was lost late in the war when German U-boat attacks were rare in American Waters. Data quality is low.

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 *Juan Casiano.* Operational factors are listed but do not have a risk score.

Table 1-1: Summary matrix for the vessel risk factors for the *Juan Casiano* 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)	Low	Maximum of 6,630 bbl, not reported to be leaking	**High**
	A2: Oil Type	Low	Bunker oil is heavy fuel oil, a Group IV oil type; it is not known whether the vessel carried cargo oil in addition to the bunker fuel	
	B: Wreck Clearance	High	Vessel not reported as cleared	
	C1: Burning of the Ship	High	No fire was reported	
	C2: Oil on Water	Low	No oil is known to have been reported on the water	
	D1: Nature of Casualty	High	Storm	
	D2: Structural Breakup	Low	Unknown structural breakup	
Archaeological Assessment	Archaeological Assessment	Low	Limited sinking records of this ship were located and no site reports exist, assessment is believed to have limited accuracy	**Not Scored**
Operational Factors	Wreck Orientation	Low	Unknown, potential to be upright	**Not Scored**
	Depth	Low	>1,700 ft	
	Visual or Remote Sensing Confirmation of Site Condition	Low	Location unknown	
	Other Hazardous Materials Onboard	Low	Unknown	
	Munitions Onboard	Low	Unknown	
	Gravesite (Civilian/Military)	High	Yes	
	Historical Protection Eligibility (NHPA/SMCA)	High	NHPA	

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 *Juan Casiano* this would be about 7,000 bbl (rounded up from 6,630 bbl) based on current estimates of the maximum amount of oil remaining onboard the wreck.

The likeliest scenario of oil release from most sunken wrecks, including the *Juan Casiano,* 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 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 *Juan Casiano*.

Scenario Type	Release per Episode	Time Period	Release Rate	Relative Likelihood	Response Tier
Chronic (0.1% of WCD)	7 bbl	Fairly regular intervals or constant	100 bbl over several days	More likely	Tier 1
Episodic (1% of WCD)	70 bbl	Irregular intervals	Over several hours or days	Most Probable	Tier 1-2
Most Probable (10% of WCD)	700 bbl	One-time release	Over several hours or days	Most Probable	Tier 2
Large (50% of WCD)	3,500 bbl	One-time release	Over several hours or days	Less likely	Tier 2-3
Worst Case	7,000 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.

As discussed in the NOAA 2013 Risk Assessment for Potentially Polluting Wrecks in U.S. Waters, NOAA identified 87 high and medium priority wrecks for screening-level risk assessment. Within the available funds, it was not feasible to conduct computer model simulations of all 87 high and medium priority wrecks. Therefore, efforts were made to create "clusters" of vessels in reasonable proximity and with similar oil types. In general, the wreck with the largest potential amount of oil onboard was selected for modeling of oil release volumes, and the results were used as surrogates for the other vessels in the cluster. In particular, the regression curves created for the modeled wreck were used to determine the impacts to water column, water surface, and shoreline resources. The *Juan Casiano*, with up to 7,000 bbl of heavy fuel onboard, was clustered with the *George MacDonald*, which was modeled at 115,000 bbl of heavy fuel oil. Figure 2-1 shows the location of both vessels.

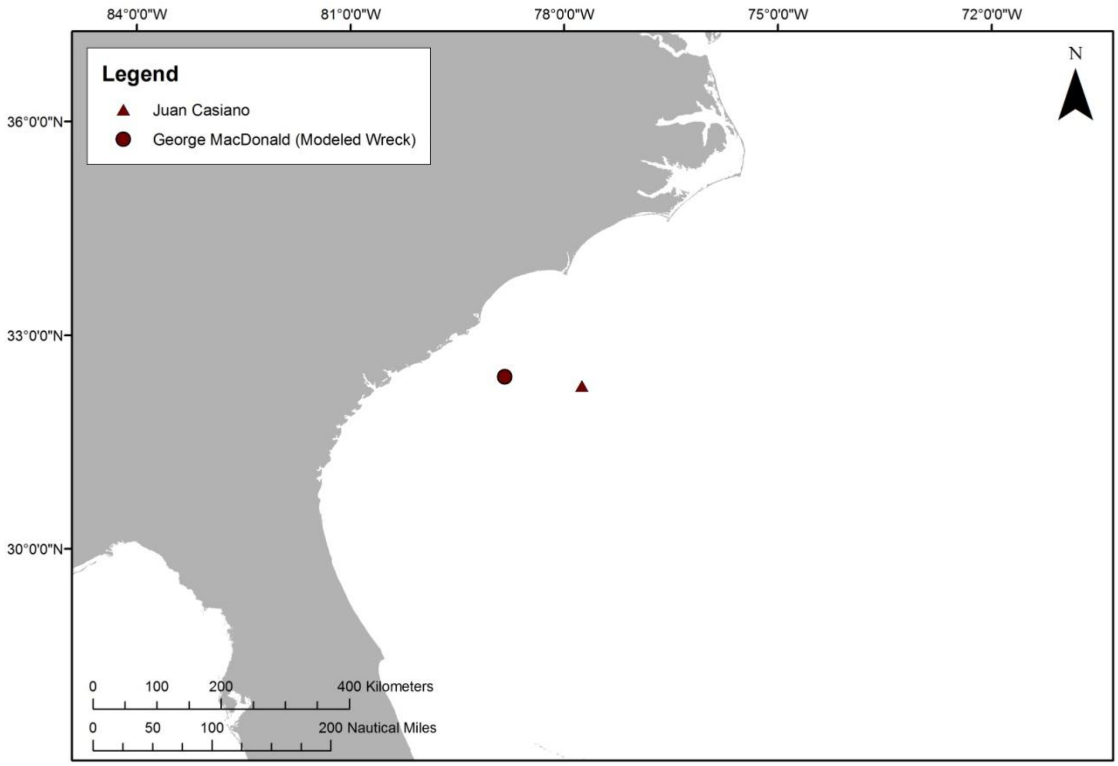


Figure 2-1: Location of the *Juan Casiano* (red triangle), the wreck discussed in this package, and the *George MacDonald* (red circle) which was the wreck that was actually modeled in the computer modeling simulations. The results for the *George MacDonald* are used to estimate the impacts of releases from the *Juan Casiano*, as discussed in the text.

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 *Juan Casiano* contained a maximum of 6,630 bbl of heavy fuel oil. Thus, the spill model for the *George MacDonald*, which was run using heavy fuel oil, was used for this assessment of the *Juan Casiano*.

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 2-2a 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 *Juan Casiano* 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

[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. Final Report, Office of Environmental Policy and Compliance, U.S. Dept. Interior, Washington, DC.

scenarios, which is shown in Figure 2-2, which is the regression curve for the *George MacDonald*. Using this figure, the water column impacts can be estimated for any spill volume. On Figure 2-2, arrows are used to indicate the where the WCD for the *Juan Casiano* plots on the curve and how the area of the water column impact is determined.

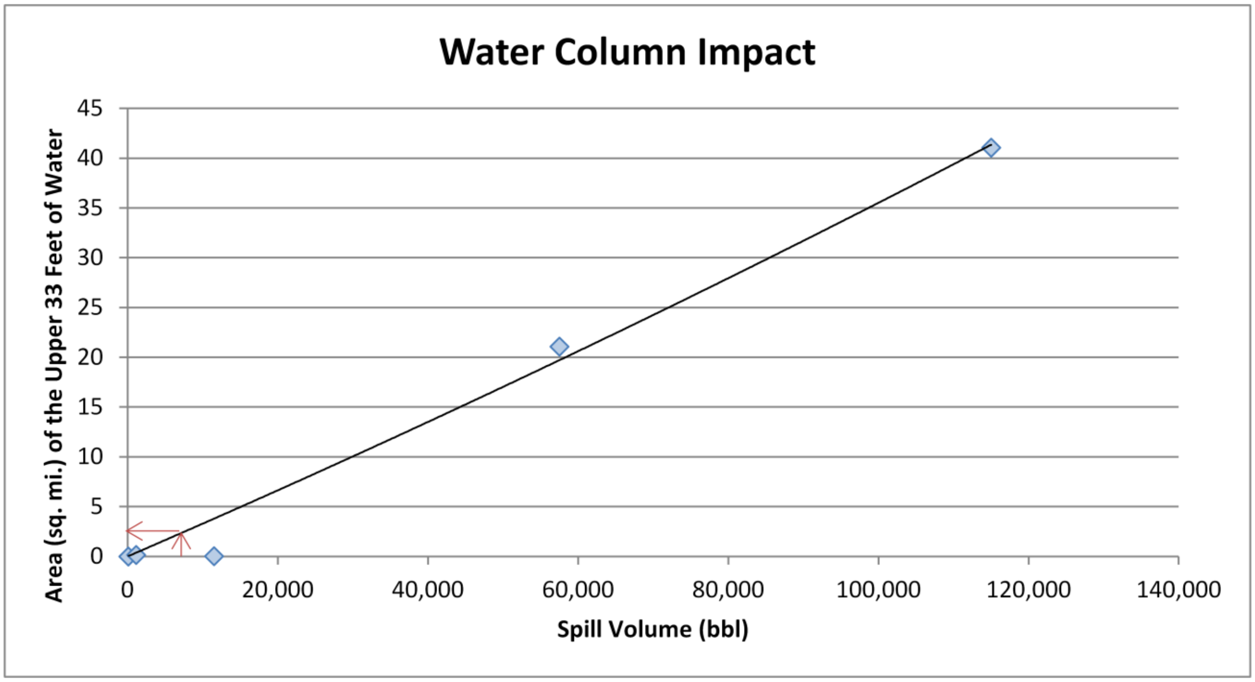


Figure 2-2: Regression curve for estimating the area of water column at or above 1 ppb aromatics impacted as a function of spill volume for the *Juan Casiano*. This regression curve was generated for the *George MacDonald*, which has the same oil type and similar volume of potential releases as the *Juan Casiano*. The arrows indicate where the WCD for the *Juan Casiano* falls on the curve and how the area of water column impact can be determined for any spill volume.

Potential Water Surface Slick

The slick size from an oil release 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 for the *George MacDonald* then using the regression curve shown in Figure 2-3 to calculate the values for the different release scenarios for the *Juan Casiano*. 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 the oil is not able to spread any thinner, owing to its high viscosity. 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. Surface expression is likely to be in the form of sheens, tarballs, and streamers. The location, size, shape, and spread of the oil slick(s) from an oil release from the *Juan Casiano* will depend on environmental conditions, including winds and currents, at the time of release and in its aftermath. Refer to the risk assessment package for the *George MacDonald* for maps (Figs. 2-2 and 2-3) showing the areas potentially affected by slicks using the Most Probable volume and the socio-economic and ecological thresholds.

Table 2-3: Estimated slick area swept on water for oil release scenarios from the *Juan Casiano*, based on the model results for the *George MacDonald*.

Scenario Type	Oil Volume (bbl)	Estimated Slick Area Swept Mean of All Models 0.01 g/m²	Estimated Slick Area Swept Mean of All Models 10 g/m²
Chronic	7	430 mi²	430 mi²
Episodic	70	1,400 mi²	1,400 mi²
Most Probable	700	4,500 mi²	4,500 mi²
Large	3,500	10,000 mi²	10,000 mi²
Worst Case Discharge	7,000	15,000 mi²	15,000 mi²

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 for the *George MacDonald*, which is shown in Figure 2-3 and referenced in Table 2-3. Using this figure, the area of water surface with a barely visible sheen can be estimated for any spill volume from the *Juan Casiano*.

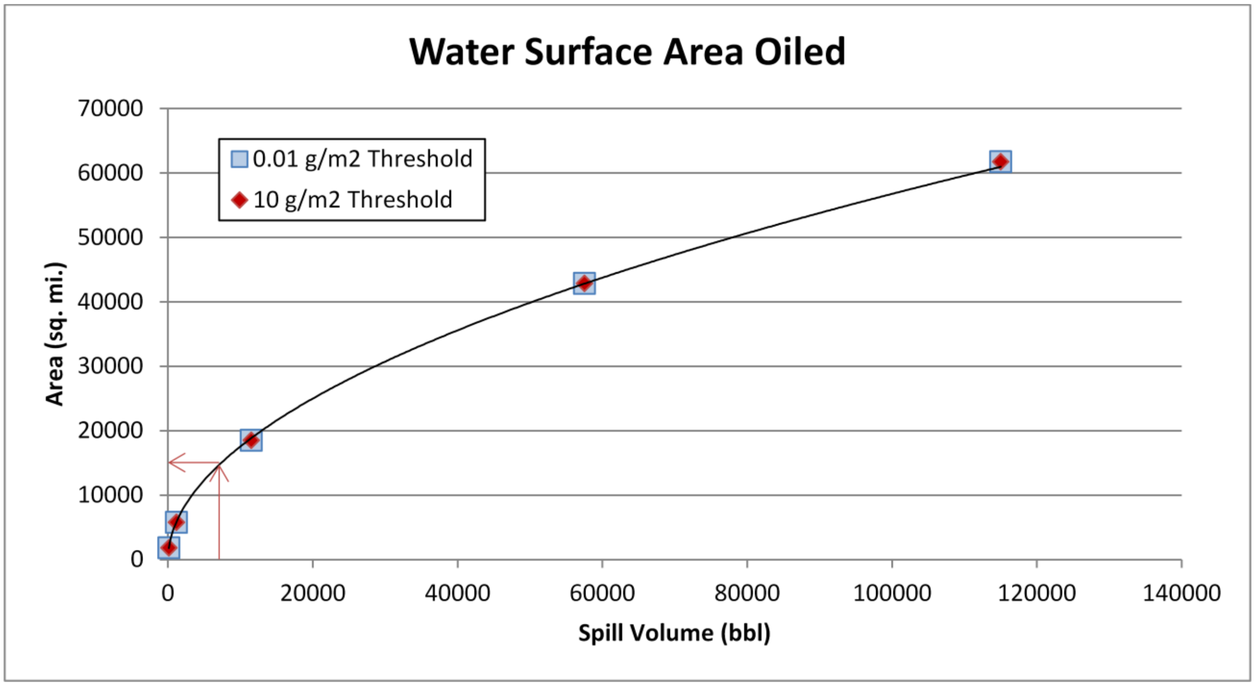


Figure 2-3: Regression curve for estimating the amount of water surface oiling as a function of spill volume for the *Juan Casiano*, showing both the ecological threshold of 10 g/m² and socio-economic threshold of 0.01 g/m², based on the model results for the *George MacDonald*. The arrows indicate where the WCD for the *Juan Casiano* falls on the curve and how the area of water surface impact can be determined for any spill volume. The curves for each threshold are so similar that they plot on top of each other.

Potential Shoreline Impacts

Based on these modeling results, shorelines from as far north as Maryland to as far south as Cape Canaveral, Florida are at risk. (Refer to Figure 2-6 in the *George MacDonald* package to see the probability of oil stranding on the shoreline at concentrations that exceed the threshold of 1 g/m^2, for the Most Probable release). 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. Estimated miles of shoreline oiling above the socio-economic threshold of 1 g/m^2 and the ecological threshold of 100 g/m^2 by scenario type are shown in Table 2-4.

Table 2-4: Estimated shoreline oiling from leakage from the *Juan Casiano*, based on the modeling results for the *George MacDonald*.

Scenario Type	Volume (bbl)	Estimated Miles of Shoreline Oiling Above 1 g/m^2	Estimated Miles of Shoreline Oiling Above 100 g/m^2
Chronic	7	17	0
Episodic	70	30	0
Most Probable	700	42	9
Large	3,500	51	23
Worst Case Discharge	7,000	55	29

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 for the *George MacDonald*, as detailed in Table 2-4 and shown in Figure 2-4. Using this figure, the shore length oiled can be estimated for any spill volume from the *Juan Casiano*.

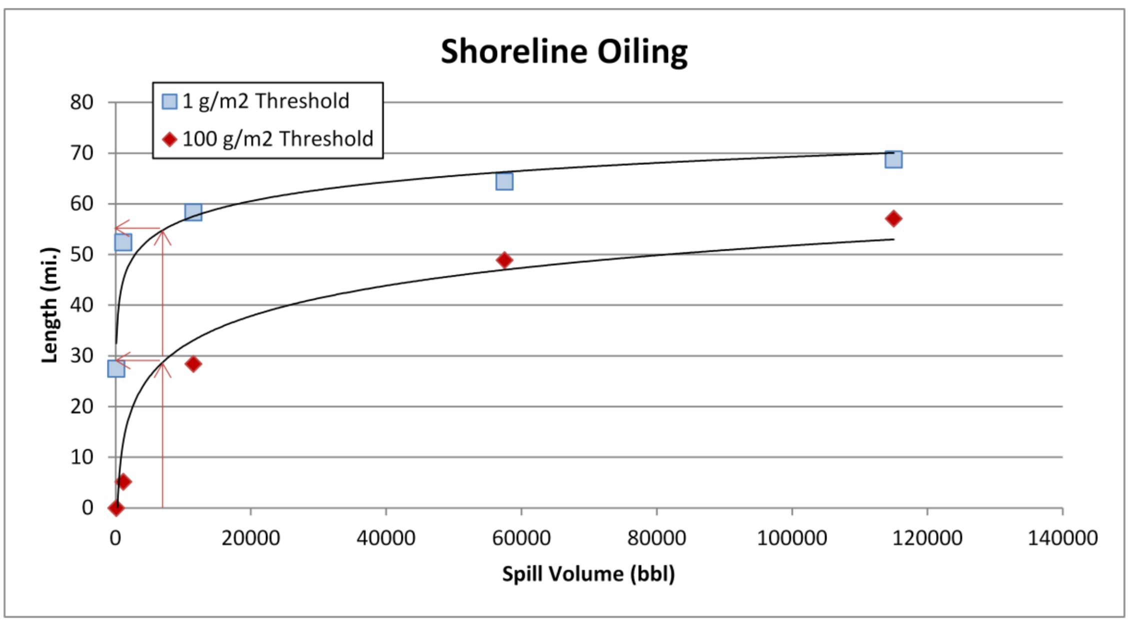


Figure 2-4: Regression curve for estimating the amount of shoreline oiling at different thresholds as a function of spill volume for the *Juan Casiano*, based on the model results for the *George MacDonald*. The arrows indicate where the WCD for the *Juan Casiano* falls on the curve and how the length of shoreline impact can be determined for any spill volume.

SECTION 3: ECOLOGICAL RESOURCES AT RISK

Ecological resources at risk from a catastrophic release of oil from the *Juan Casiano* include numerous guilds of birds (Table 3-1), particularly those sensitive to surface oiling while rafting or plunge diving to feed, that are present in nearshore/offshore waters. In addition, this region is important for nesting loggerhead sea turtles, migrating marine mammals, and commercially important fish and invertebrates, including some sensitive hard bottom habitats used by these species.

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

Species Group	Species Subgroup and Geography	Seasonal Presence
Seabirds	Seabirds • Outer Continental Shelf (OCS) offshore of Cape Hatteras, NC: greatest diversity of seabirds in SE U.S.; greatest density of tropical seabirds in SE U.S. Species include: shearwaters, storm petrels, and Bermuda petrels • Significant percentage of the global population of black-capped petrels (FE) may be present in *Sargassum* mats off Cape Hatteras and Gulf Stream off SE U.S. coast • Audubon's shearwaters (50-75% of population) concentrate along the Continental Shelf edge off NC, extending northward to the VA border (~3800 pairs)	OCS: Ranges by species but Mar-Nov peak Petrels off NC/VA coast during the summer through early fall and off SE U.S. coast in winter Shearwaters off of NC/VA: late summer
Pelagic Birds, Waterfowl, and Diving Birds	Coastal pelagic birds, waterfowl, diving birds • Mouth of Chesapeake Bay has high concentrations of species that are abundant over shoals (e.g. loons, pelicans, cormorants, sea ducks, gulls, terns, alcids); scoters are 10X more abundant than other species • Outer Banks, inshore waters NC to VA: Key foraging area for gulls and terns; key migration corridor for loons and sea ducks; NC's largest population of northern gannet and red-breasted merganser • Southeastern U.S. inshore/offshore waters: 150K loons, >15K pelicans, thousands of waterfowl, 100s of thousands of cormorants and terns, millions of gulls • Important Bird Areas (IBAs) for SC include Cape Romain NWR, Deveaux Bank, and Beaufort barrier islands: Feeding and over-wintering grounds for substantial numbers of waterfowl and sea birds as well as nesting for thousands of brown pelicans	Winter use of shoals (Dec-Mar); Summer use of shoals likely farther north Terns, gulls in spring/summer; Loons, sea ducks in spring/fall; Waterfowl, gannets, red-breasted mergansers in winter

Sea Ducks	Sea ducks (includes mean/max distance of flocks to shore, 2009-2010 data)
	• Surf scoter - 2 nm/8 nm/Black scoter -2 nm/13 nm:
	  ○ Off NC: 0-41K surf scoters, 3.5-13K black scoters
	  ○ Off SC/GA: 0-100 surf scoters, 0-15K black scoters
	• Bufflehead, mergansers, goldeneyes (<1 nm/7-14 nm)
	  ○ Off NC: 12K
	  ○ Off SC/GA: 5K
		Sea ducks surveyed in winter (peak abundances); Migration from fall to spring (Oct-Apr)

Shorebirds and Colonial Nesting Birds	• VA Barrier Island/Lagoon System: Most important bird area in VA and one of most along Atl. Coast of No. America: piping plover (FT), Wilson's plover, American oystercatcher, gull-billed tern, least tern, black skimmer; internationally significant stopover point for whimbrel, short-billed dowitcher, and red knot • Western Shore VA marshes: Extensive marshes support significant populations of many marsh nesting species • Outer Banks, Cape Hatteras, and Cape Lookout: Globally important for coastal birds with 365+ species	Winter migration stop for plovers Colonial and beach nesters peak Apr-Aug Wading and shorebirds typically present year round

Species Group	Species Subgroup and Geography	Seasonal Presence
	• Battery and Bald Head Islands, NC: Largest colonies of wading birds in NC; globally significant site with >10K nesting pairs of white ibises • Cape Romain NWR, SC: Largest wintering concentration of American oystercatchers on east coast; supports 45% and 70% of SC nesting gull-billed terns and black skimmers, respectively; Western Hemispheric Shorebird Reserve Network of international importance with up to 7K shorebirds per day • Deveaux Bank and Edisto ACE Basin NWR: Globally recognized IBAs supporting 1,000s of nesting shorebirds including least terns (ST) and Wilson's plovers (ST); >900 foraging wood storks (FE) • Bay Point Island IBA: Shorebirds and wading birds year round; wintering populations averaging >5K shorebirds per day of dunlins, dowitchers, western sandpipers, 500 red knots, sanderlings, least terns (ST), Wilson's plovers (ST), and piping plovers (FT) • Pinckney Island NWR: Important rookery for white ibis, egrets, and herons • GA coast supports significant populations of resident and migratory wading and shorebirds with wading birds most abundant in summer; beach nesting least terns (ST), Wilson's plovers (ST), piping plovers (FT) and American oystercatchers • Wassaw NWR and Altamaha River Delta: Heron and egret rookery; migrating/wintering site for piping plovers (FT) and American oystercatchers; nesting habitat for gull-billed, royal, and sandwich terns as well as black skimmers and wood storks (FE) • St. Catherines Island and Cumberland Island: Two of the most important feeding/wintering sites on Atlantic coast with thousands of shorebirds and wading birds including least terns (ST), Wilson's plovers (ST), piping plovers (FT), American oystercatchers, and wood storks (FE) • Northern FL: Globally recognized IBA (Nassau Sound) for breeding/roosting of threatened and endangered shorebirds; habitat supports numerous neotropical migrants in the spring and fall • Cape Canaveral-Merritt Island: Globally recognized IBA supports around 8K wading birds (>150 pairs of wood storks) and 14K neotropical migrants	
Sea Turtles	Nesting (annual counts, by state, along shorelines with most probable impacts) NC nesting • 650+ Loggerhead (FT) • <20 Green (FT) • <10 Leatherback (FE) SC nesting • 4,000+ Loggerhead (FT) • <5 Green sea turtle (FT) • <5 Leatherback (FE) GA nesting • <,2000+ Loggerhead (FT) • <5 Green (FT) • <15 Leatherback (FE) FL nesting (Nassau – Brevard County) • 29,000+ Loggerhead (88% in Brevard) • 6,000+ Green (91% in Brevard) • <100 Leatherback (77% in Brevard) Distribution: • Offshore hot spots not well known • Young associate with *Sargassum* mats off Cape Hatteras	Nesting season: Loggerheads/Greens (NC-GA) Adults: May-Aug Hatching: Jul-Oct Loggerheads/Greens (FL) Adults: Apr- Oct Hatching: May-Nov Leatherbacks Adults: Mar-Jul (NC-GA) Feb-Aug (FL) Hatching: May-Oct (NC-GA) Mar-Sep (FL) In water: Year round with Apr-Dec peak

Species Group	Species Subgroup and Geography	Seasonal Presence
	• Bays and sounds are foraging grounds for juvenile green, loggerhead, and Kemp's ridley (FE)	
Marine Mammals	*Baleen whales*: Primarily North Atlantic right whale (FE) with occasional humpback whale (FE), and minke whales • Right whales are critically endangered (<400 individuals left) coastal waters in the potential spill area are used as calving grounds *Inshore cetaceans:* Bottlenose dolphins frequently use coastal waters including creeks, bays, and sounds throughout area *Offshore cetaceans*: Often associated with shelf edge features, convergence zones (fronts), and *Sargassum* mats (summer • West Indian manatees are present year round, concentrated along the FL coast with common summer sightings as far north as NC	Adults migrate from feeding grounds in North Atlantic to breeding grounds further south in the winter; Right whales with calf Nov-Mar Bottlenose dolphins present year round Manatees year round and coastal waters during summer
Fish and Inverts	Coastal ocean waters support many valuable fisheries and/or species of concern in the region: • *Benthic or bottom associated*: Snapper, grouper, black sea bass, butter fish, goose fish, shrimp (white, pink, brown, and rock), golden crab, and other reef species • *Diadromous*: Alewife, blueback herring, American shad, hickory shad, Atlantic tomcod, American eel, Atlantic sturgeon (Fed. species of concern), shortnose sturgeon (FE), and striped bass • *Estuarine dependent*: Southern flounder, redfish, spotted seatrout, blue crab, Atlantic croaker, spot, weakfish, shrimp • *Estuarine resident*: Eastern oyster Important concentration/conservation areas are: • Primary nursery areas in NC bays – for estuarine dependent species • *Sargassum* off Cape Hatteras, NC and Florida is important habitat for juvenile of some pelagic fish species (i.e. dolphinfish, jacks, triggerfish, and juvenile turtles)	Benthic and midwater species are present throughout the year Anadromous fish migrate inshore to spawn in fresh water in the spring American eel migrates offshore to spawn in the winter Estuarine dependent fish migrate offshore in the fall/winter to spawn; Juveniles and adults use estuaries during the spring/summer
Benthic Habitats	Submerged aquatic vegetation is critical to numerous species and occurs inside of bays and sounds; greatest concentrations in FL coastal waters Scattered hard-bottom sites are located off NC and are considered Habitat Areas of Particular Concern (HAPC) for reef-associated fishes Nearshore hard-bottom habitat off the coast of S. FL between Brevard and Miami-Dade counties	Year round

The Environmental Sensitivity Index (ESI) atlases for the potentially impacted coastal areas from a leak from the *Juan Casiano* 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, moderate, and high for each ecological risk factor is provided. Also, the classification for the *Juan Casiano* is provided, both as text and as shading of the applicable degree of risk bullet, for the WCD release of 7,000 bbl and a border around the Most Probable Discharge of 700 bbl. Please note: The probability of oiling cannot be determined using the regression curves; probability can only be determined from the 200 model runs. Thus, the modeling results and regression curves for the *George MacDonald* are used to estimate the values used in the risk scoring for the **degree of oiling only**.

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 (not scored)

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 *Juan Casiano* is classified as Medium Risk for degree of oiling for water column ecological resources for the WCD of 7,000 bbl because the mean volume of water contaminated in the model runs was 2 mi^2 of the upper 33 feet of the water column. For the Most Probable Discharge of 700 bbl, the *Juan Casiano* is classified as Low Risk for degree of oiling because the mean volume of water contaminated was 0 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 (not scored)

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 *Juan Casiano* is classified as High Risk for degree of oiling for water surface ecological resources for the WCD because the mean area of water contaminated in the model runs was 15,000 mi^2. It is classified as Medium Risk for degree of oiling for the Most Probable Discharge because the mean area of water contaminated was 4,500 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. For the modeled wrecks, shorelines were 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. In this risk analysis for the *Juan Casiano*, shorelines have NOT been weighted by their degree of sensitivity to oiling because these data are available only for modeled vessels. Therefore, the impacts are evaluated only on the total number of shoreline miles oiled as determined from the regression curve.

Risk Factor 3C-1: Shoreline Probability of Oiling of EcoRAR (not scored)

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 *Juan Casiano* is classified as Medium Risk for degree of oiling for shoreline ecological resources for the WCD because the mean length of shoreline contaminated in the model runs was 29 miles. It is classified as Low Risk for degree of oiling for the Most Probable Discharge because the mean length of shoreline contaminated in the model runs was 9 miles.

Considering the modeled risk scores and the ecological resources at risk, the ecological risk from potential releases of the WCD of 7,000 bbl of heavy fuel oil from the *Juan Casiano* is summarized as listed below and indicated in the far-right column in Table 3-2:

- Water column resources – Low, because of the very small area of water column impacts
- Water surface resources – High, because of the very large number of wintering, nesting, and migratory birds that use ocean, coastal, and estuarine habitats at risk, sea turtle concentrations in *Sargassum* habitat, and the persistence of tarballs that can be transported long distances. 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 most of the shoreline at risk is composed of sand beaches which are relatively easy to clean, although these beaches are used by many shorebirds and sea turtles for nesting and many shorebirds as wintering and migratory stopovers

Table 3-2: Ecological risk factor scores for the **Worst Case Discharge of 7,000 bbl** of heavy fuel oil from the *Juan Casiano*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
3A-1: Water Column Probability EcoRAR Oiling	**Low**	**Medium**	**High**	N/A: Only available for modeled vessels	**Low**
3A-2: Water Column Degree EcoRAR Oiling	**Low**	**Medium**	**High**	The mean volume of water contaminated above 1 ppb was 2 mi^2 of the upper 33 feet of the water column	
3B-1: Water Surface Probability EcoRAR Oiling	**Low**	**Medium**	**High**	N/A: Only available for modeled vessels	**High**
3B-2: Water Surface Degree EcoRAR Oiling	**Low**	**Medium**	**High**	The mean area of water contaminated above 10 g/m^2 was 15,000 mi^2	
3C-1: Shoreline Probability EcoRAR Oiling	**Low**	**Medium**	**High**	N/A: Only available for modeled vessels	**Med**
3C-2: Shoreline Degree EcoRAR Oiling	**Low**	**Medium**	**High**	The length of shoreline contaminated by at least 100 g/m^2 was 29 mi	

For the Most Probable Discharge of 700 bbl of heavy fuel oil, the ecological risk from potential releases from the *Juan Casiano* is summarized as listed below and indicated in the far-right column in Table 3-3:

- Water column resources – Low, because of impacts are unlikely
- Water surface resources – Medium, because of the very large number of wintering, nesting, and migratory birds that use ocean, coastal, and estuarine habitats at risk, sea turtle concentrations in *Sargassum* habitat, and the persistence of tarballs that can be transported long distances. 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 most of the limited amount of shoreline at risk

Table 3-3: Ecological risk factor scores for the **Most Probable Discharge of 700 bbl** of heavy fuel oil from the *Juan Casiano*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
3A-1: Water Column Probability EcoRAR Oiling	Low	Medium	High	N/A: Only available for modeled vessels	Low
3A-2: Water Column Degree EcoRAR Oiling	**Low**	Medium	High	The mean volume of water contaminated above 1 ppb was 0 mi^2 of the upper 33 feet of the water column	
3B-1: Water Surface Probability EcoRAR Oiling	Low	Medium	High	N/A: Only available for modeled vessels	Med
3B-2: Water Surface Degree EcoRAR Oiling	Low	**Medium**	High	The mean area of water contaminated above 10 g/m^2 was 4,500 mi^2	
3C-1: Shoreline Probability EcoRAR Oiling	Low	Medium	High	N/A: Only available for modeled vessels	Low
3C-2: Shoreline Degree EcoRAR Oiling	**Low**	Medium	High	The length of shoreline contaminated by at least 100 g/m^2 was 9 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 *Juan Casiano* include recreational beaches from Maryland to northeastern Florida that are very highly utilized during summer, and are still in use during spring and fall for shore fishing. Four national seashores and two coastal national monuments could potentially be affected. Many areas along the entire potential spill zone contain popular seaside resorts and support recreational activities such as boating, diving, sightseeing, sailing, fishing, and wildlife viewing. The Gray's Reef National Marine Sanctuary off Georgia could also potentially be affected, along with a large number of coastal state parks.

A release could impact shipping lanes, which accommodate nearly 9,000 port calls and 382 million tonnage. Commercial fishing is economically important to the region. A release could impact fishing fleets from Maryland to Florida where regional commercial landings for 2010 exceeded $137 million.

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.

Spill response costs for a release of oil from the *Juan Casiano* 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 *Juan Casiano*.

Resource Type	Resource Name	Economic Activities
Tourist Beaches	Ocean City, MD Myrtle Beach, SC Hilton Head Island, SC Tybee Island, GA Fernandina Beach, FL Atlantic Beach, FL St. Augustine Beach, FL Daytona Beach, FL Palm Coast, FL	Potentially affected beach resorts and beach-front communities in Virginia, Maryland, North Carolina, South Carolina, Georgia, and northeastern Florida provide recreational activities (e.g., swimming, boating, recreational fishing, wildlife viewing, nature study, sports, dining, camping, and amusement parks) with substantial income for local communities and state tax income. Much of the coast is lined with economically valuable beach resorts and residential communities. Many of these recreational activities are limited to or concentrated into the late spring through the early fall months.
National Marine Sanctuary	Gray's Reef National Marine Sanctuary (GA)	Gray's Reef National Marine Sanctuary is one of the largest near shore live-bottom reefs in the southeastern U.S. The Sanctuary is popular with recreational anglers, boaters, and more experienced divers.

Resource Type	Resource Name	Economic Activities
National Seashores	Cape Hatteras National Seashore, NC Assateague Isl. National Seashore, MD/VA Cumberland Isl. National Seashore, GA Canaveral National Seashore, FL	National seashores provide recreation for local and tourist populations while preserving and protecting the nation's natural shoreline treasures. National seashores are coastal areas federally designated as being of natural and recreational significance as a preserved area. As a barrier island, Assateague Island is known for its feral horses and is also home to deer, crabs, fox, and migrating snow geese. Located in the Outer Banks, Cape Hatteras is known for its Bodie Island and Cape Hatteras Lighthouses. Popular recreation activities include windsurfing, birdwatching, fishing, shell collecting, and kayaking. The barrier islands provide refuge for endangered piping plover, seabeach amaranth, and sea turtles.
National Parks	Fort Pulaski National Monument, GA Fort Sumter, National Monument, SC	Two coastal national historic monuments provide education in Civil War history.
National Wildlife Refuges	Chincoteague NWR (VA) Wallops Island NWR (VA) Eastern Shore of Virginia NWR (VA) Back Bay NWR (VA) Mackay Island NWR (NC) Currituck NWR (NC) Pea Island NWR (NC) Cedar Island NWR (NC) Waccamaw NWR (SC) Cape Romain NWR (SC) Ernest F. Hollings ACE Basin NWR (SC) Pickney Island NWR (SC) Savannah NWR (SC) Tybee NWR (SC) Wassaw NWR (GA) Harris Neck NWR (GA) Blackbeard Island NWR (GA) Wolf Island NWR (GA) Merritt Island NWR (FL)	National wildlife refuges in five states may be impacted. These federally-managed and protected lands provide refuges and conservation areas for sensitive species and habitats.
State Parks	Assateague SP, MD Myrtle Beach SP, SC Huntington Beach SP, SC Edisto Beach SP, SC Hunting Island SP, SC Skidaway Island SP, GA Fort McAllister SP, GA Bulow Plantation Ruins SP, FL Washington Oaks Gardens SP, FL Amelia Island SP, FL Fort Clinch SP, FL Guana River SP, FL Anastastia SP, FL Faver-Dykes SP, FL Green Mound Archaeological SP, FL Bulow Creek SP, FL Tomoka SP, FL	Coastal state parks are significant recreational resources for the public (e.g., swimming, boating, recreational fishing, wildlife viewing, nature study, sports, dining, camping, and amusement parks). They provide income to the states. State parks in several states are potentially impacted. Many of these recreational activities are limited to or concentrated into the late spring into early fall months.

Resource Type	Resource Name	Economic Activities
Commercial Fishing	A number of fishing fleets use potentially affected waters for commercial fishing.	
	Chincoteague, Virginia	Total Landings (2010): $3.5M
	Ocean City, Maryland	Total Landings (2010): $8.8M
	Chincoteague, Virginia	Total Landings (2010): $3.5M
	Beaufort-Morehead City, NC	Total Landings (2010): $9.2M
	Belhaven-Washington, NC	Total Landings (2010): $3.7M
	Elizabeth City, NC	Total Landings (2010): $5.4M
	Engelhard-Swanquarter, NC	Total Landings (2010): $10.6M
	Oriental-Vandemere, NC	Total Landings (2010): $8.4M
	Sneads Ferry-Swansboro, NC	Total Landings (2010): $5.4M
	Wanchese-Stumpy Point, NC	Total Landings (2010): $22.0M
	Brunswick, GA	Total Landings (2010): $5.1M
	Cape Canaveral, FL	Total Landings (2010): $6.5M
	Charleston-Mt. Pleasant, SC	Total Landings (2010): $9.9M
	Darien-Bellville, GA	Total Landings (2010): $5.2M
	Fernandina Beach, FL	Total Landings (2010): $4.7M
	Georgetown, SC	Total Landings (2010): $6.0M
	Mayport, FL	Total Landings (2010): $11.0M
	Savannah, GA	Total Landings (2010): $5.0M
	Thunderbolt, GA	Total Landings (2010): $3.4M
Ports	There are a number of significant commercial ports along the Atlantic coast that could potentially be impacted by spillage and spill response activities. The port call numbers below are for large vessels only. There are many more, smaller vessels (under 400 GRT) that also use these ports.	
	Baltimore, MD	2,100 port calls annually
	Morehead City, NC	85 port calls annually
	Wilmington, NC	550 port calls annually
	Brunswick, GA	304 port calls annually
	Charleston, SC	1,818 port calls annually
	Elba Is., GA	37 port calls annually
	Fernandina, FL	3 port calls annually
	Jacksonville, FL	1,641 port calls annually
	Port Canaveral, FL	38 port calls annually
	Savannah, GA	2,406 port calls annually

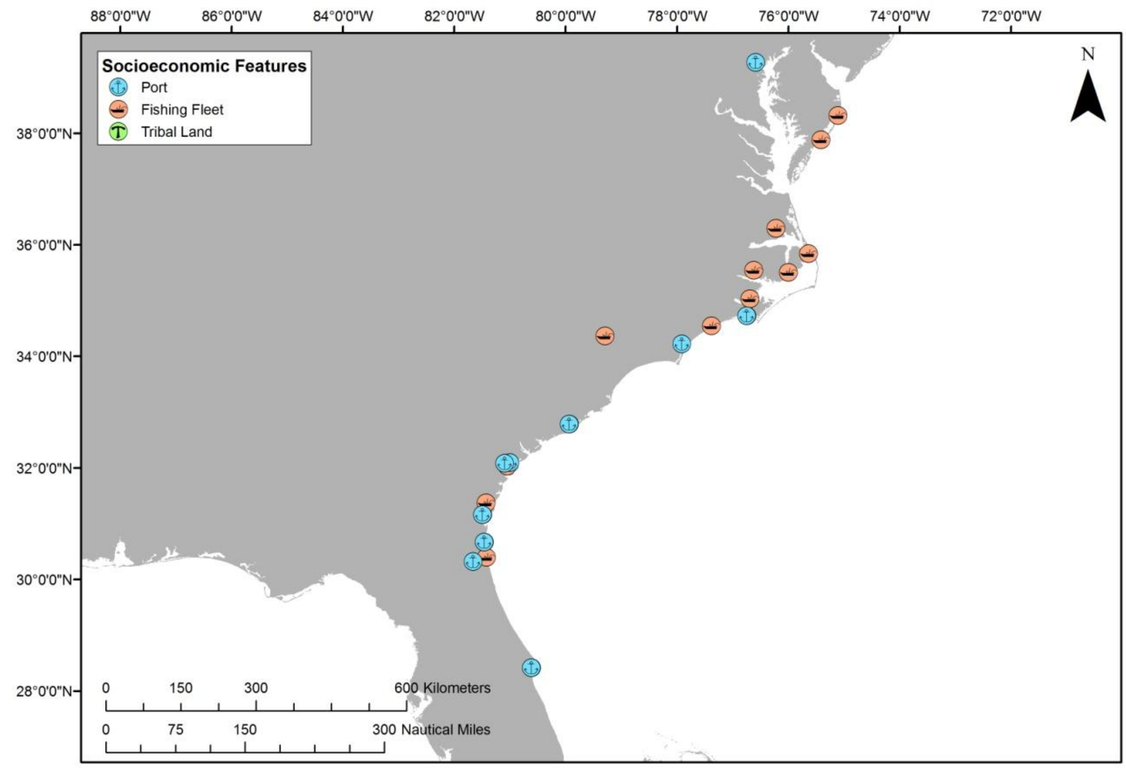


Figure 4-1: Tribal lands, ports, and commercial fishing fleets at risk from a release from the *Juan Casiano*. (Note that there are no tribal lands affected.)

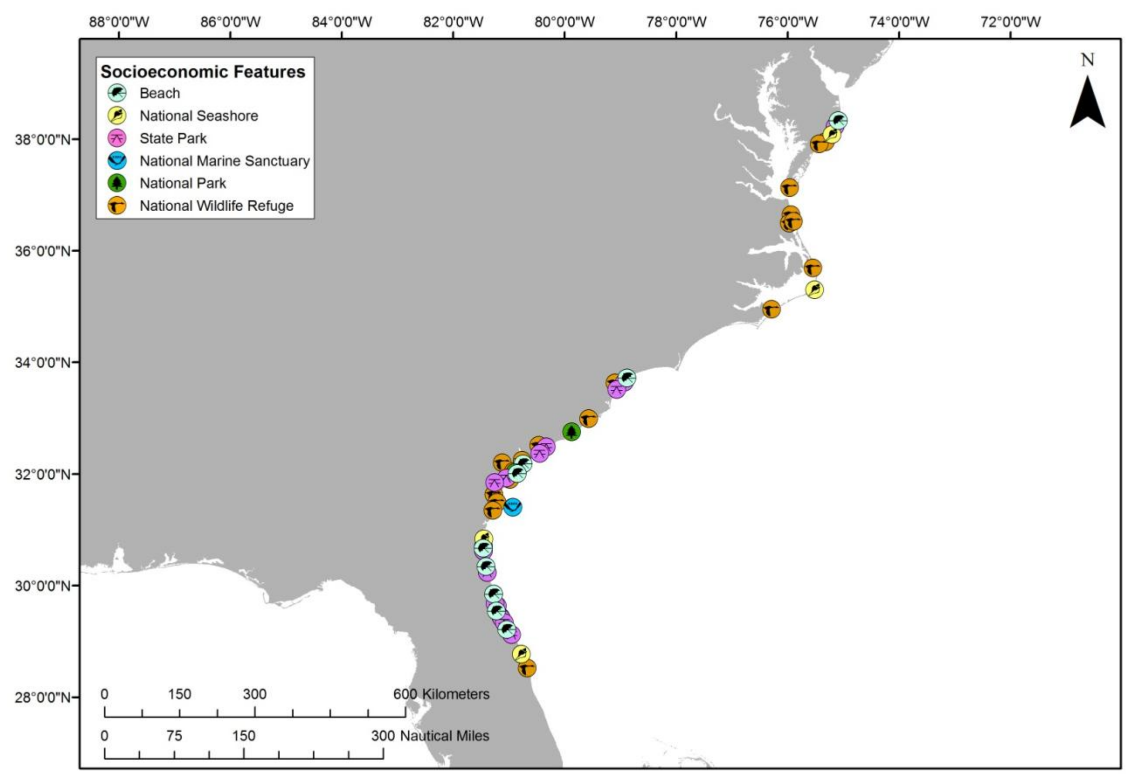


Figure 4-2: Beaches, coastal state parks, and Federal protected areas at risk from a release from the *Juan Casiano*.

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 were one. 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 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 *Juan Casiano*, shading indicates the degree of risk for a WCD release of 7,000 bbl and a border indicates degree of risk for the Most Probable Discharge of 700 bbl. Please note: The probability of oiling cannot be determined using the regression curves; probability can only be determined from the 200 model runs. Thus, the modeling results and regression curves for the *George MacDonald* are used to estimate the values used in the risk scoring for the **degree of oiling only**.

Risk Factor 4A-1: Water Column: Probability of Oiling of SRAR (not scored)

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 *Juan Casiano* is classified as Medium Risk for degree of oiling for water column socio-economic resources for the WCD of 7,000 bbl because the mean volume of water contaminated in the model runs was 2 mi^2 of the upper 33 feet of the water column. For the Most Probable Discharge of 700 bbl, the *Juan Casiano* is classified as Low Risk for degree of oiling because the mean volume of water contaminated was for water surface socio-economic resources for the Most Probable Discharge was 0 mi^2 of the upper 33 feet of the water column.

Risk Factor 4B-1: Water Surface Probability of Oiling of SRAR (not scored)

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 *Juan Casiano* is classified as High Risk for degree of oiling for water surface socio-economic resources for the WCD of 7,000 bbl because the mean area of water contaminated in the model runs was 15,000 mi^2. The *Juan Casiano* is classified as Medium Risk for degree of oiling for water surface socio-economic resources for the Most Probable Discharge because the mean area of water contaminated was 4,500 mi^2.

Risk Factor 4C: Shoreline Impacts to SRAR

The impacts to different types of shorelines vary based on economic value. For the modeled wrecks, 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"). In this risk analysis for the *Juan Casiano*, shorelines have NOT been weighted by their degree of sensitivity to oiling because these data are available only for modeled vessels. Therefore, the impacts are evaluated only on the total number of shoreline miles oiled as determined from the regression curve.

Risk Factor 4C-1: Shoreline Probability of Oiling of SRAR (not scored)

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 *Juan Casiano* is classified as Medium Risk for degree of oiling for shoreline socio-economic resources for the WCD because the mean length of shoreline contaminated in the model runs was 55 miles. The *Juan Casiano* is classified as Medium Risk for degree of oiling for shoreline socio-economic resources for the Most Probable Discharge because the mean length of shoreline contaminated was 42 miles.

Considering the modeled risk scores and the socio-economic resources at risk, the socio-economic risk from potential releases of the WCD of 7,000 bbl of heavy fuel oil from the *Juan Casiano* is summarized as listed below and indicated in the far-right column in Table 4-2:

- Water column resources – Low, because very little water column would be impacted in important fishing grounds
- Water surface resources – High, because a large offshore area would be affected in an area of important shipping lanes and a national marine sanctuary. 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 a moderate amount of shoreline would be impacted with the persistent oil and tarballs and would be relatively easy to clean, although there are a large number of potentially vulnerable socio-economic resources located along the shoreline

Table 4-2: Socio-economic risk factor ranks for the **Worst Case Discharge of 7,000 bbl** of heavy fuel oil from the *Juan Casiano*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
4A-1: Water Column Probability SRAR Oiling	Low	Medium	High	N/A: Only available for modeled vessels	Low
4A-2: Water Column Degree SRAR Oiling	Low	**Medium**	High	The mean volume of water contaminated above 1 ppb was 2 mi^2 of the upper 33 feet of the water column	
4B-1: Water Surface Probability SRAR Oiling	Low	Medium	High	N/A: Only available for modeled vessels	High
4B-2: Water Surface Degree SRAR Oiling	Low	Medium	**High**	The mean area of water contaminated above 0.01 g/m^2 was 15,000 mi^2	
4C-1: Shoreline Probability SRAR Oiling	Low	Medium	High	N/A: Only available for modeled vessels	Med
4C-2: Shoreline Degree SRAR Oiling	Low	**Medium**	High	The length of shoreline contaminated by at least 1 g/m^2 was 55 mi	

For the Most Probable Discharge of 700 bbl, the socio-economic risk from potential releases of heavy fuel oil from the *Juan Casiano* is summarized below and indicated in the far-right column in Table 4-3:

- Water column resources – Low, because virtually no water column would be impacted in important fishing grounds
- Water surface resources – Medium, because a large offshore area would be affected in an area of important shipping lanes. 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 a moderate amount of shoreline would be impacted with the persistent oil and tarballs and would be relatively easy to clean, although there are a large number of potentially vulnerable socio-economic resources located along the shoreline

Table 4-3: Socio-economic risk factor ranks for the **Most Probable Discharge of 700 bbl** of heavy fuel oil from the *Juan Casiano*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
4A-1: Water Column Probability SRAR Oiling	Low	Medium	High	N/A: Only available for modeled vessels	Low
4A-2: Water Column Degree SRAR Oiling	**Low**	Medium	High	The mean volume of water contaminated above 1 ppb was 0 mi² of the upper 33 feet of the water column	
4B-1: Water Surface Probability SRAR Oiling	Low	Medium	High	N/A: Only available for modeled vessels	Med
4B-2: Water Surface Degree SRAR Oiling	Low	**Medium**	High	The mean area of water contaminated above 0.01 g/m² was 4,500 mi²	
4C-1: Shoreline Probability SRAR Oiling	Low	Medium	High	N/A: Only available for modeled vessels	Med
4C-2: Shoreline Degree SRAR Oiling	Low	**Medium**	High	The length of shoreline contaminated by at least 1 g/m² was 42 mi	

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

The overall risk assessment for the *Juan Casiano* 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 site formation processes have worked on this 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. As noted in Sections 3 and 4, each of 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. Please note: The probability of oiling cannot be determined using the regression curves; probability can only be determined from the 200 model runs. Thus, the modeling results and regression curves for the *George MacDonald* were used to estimate the values used in the risk scoring for the **degree of oiling only**.

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, *Juan Casiano* scores High with 15 points; for the Most Probable Discharge, *Juan Casiano* scores Medium with 12 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 *Juan Casiano*. The final determination of what type of action, if any, rests with the U.S. Coast Guard.

Juan Casiano	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 *Juan Casiano*.

Vessel Risk Factors		Data Quality Score	Comments		Risk Score
Pollution Potential Factors	A1: Oil Volume (total bbl)	Low	Maximum of 6,630 bbl, not reported to be leaking		**High**
	A2: Oil Type	Low	Bunker oil is heavy fuel oil, a Group IV oil type; it is not known whether the vessel carried cargo oil in addition to the bunker fuel		
	B: Wreck Clearance	High	Vessel not reported as cleared		
	C1: Burning of the Ship	High	No fire was reported		
	C2: Oil on Water	Low	No oil is known to have been reported on the water		
	D1: Nature of Casualty	High	Storm		
	D2: Structural Breakup	Low	Unknown structural breakup		
Archaeological Assessment	Archaeological Assessment	Low	Limited sinking records of this ship were located and no site reports exist, assessment is believed to have limited accuracy		**Not Scored**
Operational Factors	Wreck Orientation	Low	Unknown, potential to be upright		**Not Scored**
	Depth	Low	>1,700 ft		
	Visual or Remote Sensing Confirmation of Site Condition	Low	Location unknown		
	Other Hazardous Materials Onboard	Low	Unknown		
	Munitions Onboard	Low	Unknown		
	Gravesite (Civilian/Military)	High	Yes		
	Historical Protection Eligibility (NHPA/SMCA)	High	NHPA		
				WCD	**Most Probable**
Ecological Resources	3A: Water Column Resources	High	Small impacts offshore where sensitive resources are less concentrated	**Low**	**Low**
	3B: Water Surface Resources	High	Forms persistent tarballs that can travel long distances posing risks to birds and sea turtles, esp. when concentrated in convergence zones and *Sargassum*	**High**	**Med**
	3C: Shore Resources	High	Persistent tarballs strand mostly on sand beaches	**Med**	**Low**
Socio-Economic Resources	4A: Water Column Resources	High	Virtually no water column would be impacted in important fishing grounds	**Low**	**Low**
	4B: Water Surface Resources	High	Large offshore area would be affected in an area of important shipping lanes and a national marine sanctuary	**High**	**Med**
	4C: Shore Resources	High	Moderate amount of potentially vulnerable socio-economic resources located along the shorelines at risk	**Med**	**Med**
Summary Risk Scores				**15**	**12**