



HARBORS OF REFUGE

*A PILOT STUDY IN COASTAL
LOUISIANA (2021-2023)*



EXECUTIVE SUMMARY

Harbors of refuge are designated locations where coastal vessels can seek refuge during storm conditions. They are located farther inland to mitigate storm damage to vessels and reduce the likelihood of marine debris and economic loss. Most harbors of refuge are located in southeast and south-central Louisiana, with few options in southwest Louisiana as evidenced by the damage caused from Hurricane Laura in 2020.

Louisiana Sea Grant (LSG) conducted a pilot project to assess the geographical, legal, and socioeconomic needs for improved access to harbors of refuge in Louisiana, focusing on areas

in southwestern Louisiana affected by Hurricane Laura. Simultaneously, LSG convened an advisory board of key decision-makers and stakeholders to create a two-way information exchange between research and decision-making as a mechanism for strengthening local capacity to support implementation.

The full report will go over the background and need for this study, as well as its findings, analysis, and next steps. The study's analysis is divided into three sections: social, policy, and spatial. Supporting documents appear in the appendices.

BACKGROUND

“I didn’t think we was gonna make it from 1:00 a.m. to 4:00 a.m. I said, “I just don’t know.” I mean, I don’t think the boats was gonna take it. Had a little boat sunk and, I mean, it tore my boat all up, and knocked the windows out and stuff flying out, and all my paperwork and everything flew overboard.”

-shrimp fisherman who stayed on his boat at the Port of Lake Charles during Hurricane Laura in 2020

During the 2020 hurricane season, three hurricanes and two tropical storms made landfall in the state. One of these storms, Hurricane Laura, devastated the Lake Charles area. Any coastal vessels without refuge farther inland were lost, sunk, or otherwise damaged. Aside from costs to the vessel owners themselves, lost and sunken vessels create navigational and environmental hazards with recovery costs that are allocated to taxpayers.

Storm damage and navigational obstructions have negative impacts on many industries, including commercial fishing. The commercial fishing fleet in the Lake Charles area has expressed the need for a harbor of refuge, a publicly recognized body of water farther inland where they can moor their boats during natural disasters. Lafourche and St. Bernard Parishes have successfully used harbors of refuge to mitigate the damage and costs associated with hurricanes, but no similar methods have been implemented in Southwest Louisiana.

Although much research has been dedicated to terrestrial and road-based evacuation, less attention has been paid to aquatic solutions and storm

preparedness for vessel owners in Louisiana. One study, a 2015 report titled “Vermilion Bay Regional Harbor of Refuge” prepared by Louisiana Sea Grant in cooperation with several state and local partners, found that harbors of refuge are listed as priority needs in the Hazard Mitigation Plans for Vermilion and Iberia parishes. As of 2015, approximately 200 Vermilion Bay commercial fishing vessels were said to need emergency mooring locations that are sufficiently inland to avoid significant storm surge damages. Two possible locations were identified on the Vermilion River within Palmetto Island State Park. One privately owned site was proposed for mooring infrastructure in the Delcambre Canal, and the Port of West St. Mary owns 100 acres of land, with approximately 1300 feet of waterfront space along the Charenton Canal.

LSG conducted a pilot project to assess the geographical, legal, and socioeconomic needs for improved access to harbors of refuge in Louisiana, focusing on areas in southwestern Louisiana affected by Hurricane Laura. Specifically, we focused on the Hurricane Laura Impact Zone, which roughly corresponds to Cameron and Calcasieu Parishes. Simultaneously, LSG convened an advisory board of key decision-makers and stakeholders to create a two-way information exchange between research and decision-making as a mechanism for strengthening local capacity to support implementation.

ADVISORY COMMITTEE

LSG convened an advisory committee of key decision-makers and stakeholders to create a two-way information exchange between research and decision-making. This committee included representatives from ports, commercial fishermen, and state, federal agencies. Membership included the organizations listed below:

- Louisiana Office of Community Development
- Louisiana Department of Wildlife and Fisheries
- National Oceanic and Atmospheric Administration, Disaster Preparedness Program
- Federal Emergency Management Agency
- U.S. Coast Guard, Morgan City
- U.S. Coast Guard, Lafayette
- Lake Charles Harbor and Terminal District
- Louisiana Fishing Community Recovery Coalition

The committee met in person to review the project and to provide feedback on June 8, 2022. The committee met again on November 10, 2022 for an in-depth discussion of LSG’s Harbor of Refuge inventory and visualization mapping. The committee will continue to provide input on an as needed basis.

FINDINGS

What is a harbor of refuge?

We focused on publicly recognized and known harbors of refuge, regardless of physical characteristics. This excludes personally known tie-up locations, commonly referred to as “hidey holes” to protect the private nature of those locations. Therefore, the inventory includes any publicly advertised locations or locations that receive public funding to serve as official harbor of refuge during storm events. While the right to tie up is discussed in the legal analysis below, this project does not intend to capture individual locations of boat owners tying up during storms.

Why the term “harbors of refuge”?

Harbors of refuge are sometimes colloquially referred to as “safe harbors.” All the harbors listed in the report provide harbor, however do not explicitly guarantee safety for vessels and their personnel.

Characteristics of a Harbor of Refuge:

- Publicly known as a place to seek refuge during storms
- Some type of public funding, at least for dredging
- Space for commercial size/not easily trailerable vessels
- Tie-ups for vessels

Inventory of Louisiana Harbors of Refuge:

Current:

1. Golden Meadow in Port Fourchon - formal, only operational during a storm.
2. Port of Lake Charles - During a hurricane, the port provides refuge for all vessels on a first-come, first-served basis. The port requires vessel operators to sign an emergency berth application when seeking refuge.
3. LaSAFE in Empire, Louisiana - became operational in 2022.

4. St. Bernard Harbor of Refuge in Violet, Louisiana - Following Hurricanes Katrina, Rita and subsequent events, this harbor received public funding for dredging. It maintains a minimum water depth of 33 feet.
5. Houma City Dock - Public - Terrebonne Parish Consolidated Government (TPCG)
6. Company Canal in Bourg, Louisiana - owned by TPCG. Upgraded and expanded after Katrina.

Proposed:

1. Palmetto Island, Abbeville, Louisiana

Table 1. Characteristics of Harbors of Refuge

Harbor	Houma City Dock	LaSAFE Harbor of Refuge	St. Bernard Harbor of Refuge	Golden Meadow Harbor of Refuge	Company Canal in Terrebonne Parish	Port of Lake Charles	Proposed Palmetto Island
Address	8224 Park Avenue	Empire Boat Harbor, LA-23 N	6172 E St. Bernard Hwy	21175 Highway One	468 Texas Gulf Rd.	150 Marine St.	None
Location	Houma, LA 70364	Buras, LA 70041	Violet, LA 70092	Golden Meadow, LA 70357	Bourg, LA 70343	Lake Charles, LA 70601	Abbeville, LA 70510
Waterway	Intracoastal Waterway at Bayou Terrebonne	Mississippi River, Empire Lock, Adams Bay	Mississippi River, Bayou Dupre	Bayou Lafourche	Intracoastal Waterway	Calcasieu River	Vermilion River
Likely Fisher Origin	Morgan City area	New Orleans area	New Orleans area	Morgan City area	Morgan City area	Lake Charles area	Intracoastal City area
Status	Designated	Designated	Designated	Designated	Designated	Designated	Proposed
Slips	5	Not available	Not available	5	Not available	Not available	Not available
Slip Width (ft)	15-20	Not available	Not available	75-108	Not available	Not available	Not available
Depth (ft)	Not available	<1	33	1-3	Not available	1-45	Not available
Dist. To Open Water (mi)	29.70	1.60	6.40	20.30	29.60	14.25	10.50
Near Public Land	Yes	Yes	Yes	No	Yes	Yes	Yes
Latitude	29.598925	29.376957	29.898778	29.345314	29.576487	30.217616	29.863832
Longitude	-90.710846	-89.594272	-89.902278	-90.247176	-90.589215	-93.250858	-92.130360

**Would also include information on moorings, cleats, pilings, piling height range (ft), tie-ups, dockage (ft), size, and space if that information was available.*

SOCIAL ANALYSIS

“Louisiana, hands down is the worst state for storms for refuge....Well, there’s no accessibility to anything. You’re very limited. And then whatever is there, they’ve got 20 work boats tied up. And then, there’s so many different elements involved with the storm here than anywhere else.”

– survey respondent

In 2021, Louisiana Sea Grant conducted a survey (see Appendix A for survey questions) of commercial fishermen as well as semi-structured interviews with commercial fishermen who had a boat working during Hurricane Laura. Of 69 respondents, 59 completed the full survey. The majority of respondents identified as Asian (60%), were on average older (mean age 57) had been in the industry for 30 years, worked on boats 41 feet or longer and primarily fished shrimp (90%). See Table 2 for demographics.

Table 2. Demographics of Fishermen

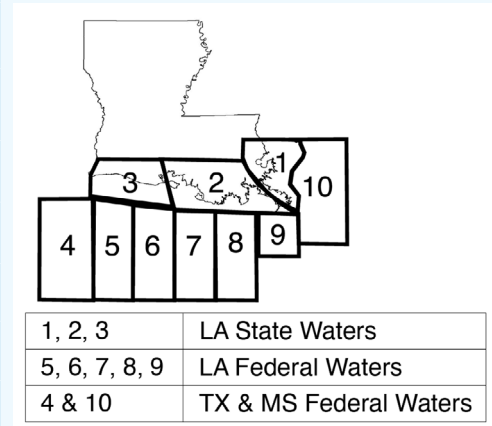
Mean age	57.55172 years
Mean time in industry	30.47273 years
% White	22.39%
% Asian	59.70%
% Vietnamese speakers	14.93%
Type of fishing	Blue crab 1.69% Finfish 3.39% Oyster 3.39% Shrimp 91.53%
% Insured	43.10%

During the regular fishing season, respondents primarily operated exclusively in Louisiana state (42%) or federal (11%) waters, although some also operated in some combination of Louisiana state or federal and Mississippi or Texas federal waters (36%). See Table 3.

Table 3. Breakdown of Primary Fishing Zones

Primary Fishing Zone	# and % of respondents		
LA state 64% (38)	Zone 1	11	18.64%
	Zone 2	35	59.32%
	Zone 3	22	37.29%
LA state only: 42% (25)			
LA federal 56% (33)	Zone 5	26	44.07 %
	Zone 6	24	40.68%
	Zone 7	25	42.37%
	Zone 8	24	40.68%
	Zone 9	12	20.34 %
LA state & federal	6	10.17%	
Out of LA 36% (21)	Zone 4	19	32.20%
Out of LA only: 1.7% (1)	Zone 10	5	8.47%
LA federal & out of LA	13	22.03%	
All LA & out of LA	7	11.86%	

Figure 1. Fishing Zones Map



Survey Respondents n = 59

The majority of the respondents (52%, 30) reported that they had “ever stayed on their boat during a storm.” Explanations provided (n=8) ranged from “nowhere else to go,” to take “corrective actions” to always staying on the boat. A larger proportion (though not significantly different, statistically) of those with longer & wider vessels (41+ ft, 20+ ft) had ever stayed on the boat during a storm; this did not appear to vary by draft. Of the 45 fishermen that responded to a question asking the most important factor in the decision to seek refuge, storm surge (36%) and wind (39%) were the most cited motivations. A greater proportion of those on larger vessels (either 41+ ft long, 20+ft wide, or 5+ ft draft) chose storm surge. One larger vessel (on all measures) chose others, explaining that “wind, storm track, surge all equally important.”

Fishermen were also asked to indicate their preferences with regards to places of refuge. Our findings are well summarized by the comment of one respondent at the survey’s end, “Even though it’s like a perfect canal or something, you get in, you still gotta have some kind of structure to tie to.” Among the 45 respondents, when asked to choose the three most important factors, the presence of pilings, available space, distance from the vessel’s location, and other tie-ups were the most chosen in order by

frequency (see Table 4). Distance from the vessel was chosen only by a proportionally greater number of longer and wider vessels, yet the same pattern was not evident with draft. Only those with larger draft and wider breadth vessels selected depth and cleats. Although these patterns were apparent, given the smaller number of completed surveys differences were not statistically significant.

Table 4. Preferred Characteristics Based on Primary Fishing Zone

	Fishing Zone						
	LA state	LA federal	LA both	Out of LA	LA fed & out LA	All 3	TOTAL
Space	52.94% (9)	50.0% (3)	50.00% (2)	0	25.00% (3)	66.67% (4)	46.67% (21) p= 0.472
Cleats	11.76% (2)	16.67% (1)	25.00% (1)	0	16.67% (2)	33.33% (2)	17.78% (8) p= 0.814
Piling	29.41% (5)	83.33% (5)	50.00% (2)	0	58.33% (7)	83.33% (5)	53.33% (24) p= 0.078
Other tieups	41.18% (7)	50.00% (3)	0	0	25.00% (3)	33.33% (2)	33.33% (15) p= 0.463
Depth	0	16.67% (1)	0	0	8.33% (1)	16.67% (1)	6.67% (3) p= 0.481
Designated harbor	17.65% (3)	0	25.00% (1)	0	16.67% (2)	0	13.33% (6) p= 0.608
Distance from vessel	41.18% (7)	16.67% (1)	25.00% (1)		50.00% (6)	16.67% (1)	35.56% (16) p= 0.345
Other factor(s)	29.41% (5)	16.67% (1)	0	0	16.67% (2)	33.33% (2)	22.22% (10) p= 0.662
Total (each row out of)	100% (17)	100% (6)	100% (4)	0	100% (12)	100% (6)	

Of the 59 respondents, 22 fished in the Hurricane Laura Impact Zone (zone 3 in Figure 1). The Hurricane Laura Impact Zone roughly corresponds to Calcasieu and Cameron Parishes in southwest Louisiana. The factors motivating decisions to seek refuge for

the 15 who answered this question were storm surge (40%, 6), storm track and wind equally (each 26.67%, 4) and the one who indicated storm intensity (6.67%) specified “decisions for weak storm are different than decision for strong storm.” For the same 15 respondents, the most important factors in a refuge were space (60%, 9) and pilings (46.67%, 7), followed closely by cleats, other tie-ups and distance from the vessel (each 33.33%, 5). Of the three that chose other factors, “something to tie to, even a big tree” and “rope the higher the pilings the better” were their explanations.

A number of survey respondents pointed to more specific characteristics of a quality refuge when asked to provide additional comment, though these comments showed some discrepancies. Comments registered that permanent pilings, not trees as they can “blow over” appeared consistent. A few respondents offered explanations about the depth of water preferred, noting that while it was necessary to have 3-4 feet of depth to allow for the vessel’s draft (one suggested no less than 6 feet), too much water was a problem, “the depth of the water means a lot because the wave’s only gonna get half as deep as it. If it’s 10 foot of water, you can only get a five-foot wave. You got 30 feet of water, you can get a pretty good wave.” Small canals and other small spaces provide protection from wind and other boats.

Interviews with five owners of vessels that experienced Hurricane Laura revealed similar preferences, specifically for a place with “tall pilings so when you tie up you let your lines loose enough whereas the tide comes up the boat will rise, and it won’t be tied to the dock tight, and then the boats lean over,” and noting that “Somewhere out of the wind is the safest place.”

Although one preferred steel and cement, another scorned concrete stating “Concrete? Absolutely not. Concrete eats everything unless you could put a piece of chain around it.” With regards to the depth of the harbor, “most boats around here are shallow draft... we’d probably need at least 3 or 4 foot depth when the wind starts pushing the tide in.”

Previous surveys indicated that in nearly all cases, people responded that they docked at the same place for Hurricanes Katrina, Gustav, and Isaac.



Thu Bui and Jennifer Scott interview Captain Binh Truong in Intracoastal City, LA (2021).

POLICY CONSIDERATIONS

“Just if you get behind something, something high to get behind, a good dock to tie to, I mean, we don’t ask for much. Just someplace to go and hide. When you live in Cameron, you just get used to it. You don’t ask for much because you don’t get much.”

Legal issues with regards to the right to tie up during a storm and issues of liability are key to understanding the construction and management of harbors of refuge. Additionally, existing operational guidance that governs existing harbors of refuge.

Right to Tie Up

Vessel owners, both commercial and recreational, have a legal right to moor their vessels in preparation of a storm or natural disaster and when incidental to navigation, even though banks of natural, navigable rivers and lakes are privately owned lands subject to public use. This right does not, however, include mooring vessels indefinitely or for the purposes of hunting or camping. The right to tie up is provided by Louisiana Civil Code articles 452 and 456.

“I’ve always heard that if a vessel is in danger, they can’t legally stop you from tying at a safe port...They can’t stop you. It’s what I’ve always heard. Now, I don’t know whether that’s true or not.”

What are the rules for tying up somewhere? What are the rules or regulations?

Male Speaker 2: To me, when you get off in them little canals, a lot of it’s private owned. So, if you know somebody knows somebody, one of them deals, it just happened to be we knew somebody that knew

somebody and he said put us there. Other than that, you gotta go some kind of public dock, and then you gotta go by their rules.

Male Speaker 1: And, like our rules at the city dock, can't get off the boat. Somebody got to be on the boat the whole time it's there. But, I mean, everybody's trying to get what they're gonna lose out to save whatever they can, and you're telling them where they can't leave the boat.

Liability

When a vessel is moored, its owner may be liable for damages caused by the vessel. During a severe weather event, however, that liability may be rebutted. Louisiana courts have found that when a vessel owner anticipates severe weather and takes reasonable precautions and preparations under the circumstances, they are relieved of liability. This means that if a vessel is properly secured but comes loose because of storm conditions, the owner is not responsible for any damages to property caused by the vessel. But if the vessel is not properly secured, or is anchored in open water, the owner is still liable for damage caused by it.

"1: They had a port authority guy come up in a little police car, and he made us, like I said, sign that paper, name of the boat, who was gonna be on the boat at all times. I mean, but I ain't gonna lie. I signed my name on the paper. But, I had a problem. I had four kids at home that I had to get out of there. So, I left the boat. I mean, what do you do? I can't leave my kids behind because my boat's there. I mean, when the storm got close, and it got to us, I mean, I was on my boat."

1. Port Fourchon Harbor of Refuge - Golden Meadow, Louisiana

This harbor of refuge is unique because it operates under a legally adopted ordinance which provides for a very formal operational structure. For example, only commercial fishing vessels 90 feet long or less (whose primary purpose is commercial fishing or charter fishing, and whose owner possesses a Commercial Fisherman's License) may access the harbor of refuge, and only when the harbor is opened upon entering Storm Phase 1, or upon the direction of the President of the Board of Commissioners. Originally, the harbor was to open upon Storm Phase 3, but after Tropical Storm Cindy, this proved to be an insufficient amount of time to use the harbor to its fullest potential. Storm Phase 1 occurs when a weather condition is monitored and expected to make landfall within 96 hours. This location is overseen and managed by the Board of Commissioners of the Greater Lafourche Port Commission (GLPC) via Ordinance 74 (2017). When using the harbor of refuge, vessel owners release GLPC from liability for damage or injury caused by or arising out of use of the harbor. As long as the vessels are properly secured while moored, vessel owners are not liable for damage caused by their vessels during a storm. While moored, vessel crew are prohibited from fishing or performing maintenance and repair work on the vessel, and they must remain on the vessel. Once storm conditions subside and the GLPC deactivates the harbor of refuge, vessels have 72 hours to exit.

The location of Golden Meadow provides an example of something to be aware of when selecting sites for future harbors of refuge. It is located just behind the lock on Port Fourchon, and its proximity to the lock makes the harbor of refuge unusable during blue skies. Ideally, future sites would be available to use at all times rather than only during storm events.

The ordinances regulating this Harbor of Refuge can be found in *Appendix B: Resources*.



Golden Meadow, LA (2021)

2. Port of Lake Charles - Lake Charles, Louisiana

The Port of Lake Charles has formally adopted a Hurricane Preparation, Response and Recovery Plan, which outlines each port director's readiness responsibilities. The plan lists four port conditions when tropical storm force winds are expected from 72 to 12 hours, and each condition lists the directors' responsibilities during that time. The Calcasieu Ship Channel may be closed when tropical storm force winds are expected within 24 hours, and it will be closed when they are expected within 12 hours.

The Hurricane Plan also provides a berth application for vessel owners seeking refuge during storm conditions. The Emergency Berth Application and Assignment must be signed by the vessel operator to take refuge in the Port of Lake Charles during a hurricane. The application releases the port of liability for damage to vessels, cargo, and employees of the vessel while moored. It also holds vessel operators responsible for any damage caused by the docking, shifting, and sailing of their vessel. As with Port Fourchon, vessel crew are prohibited from fishing or performing maintenance while moored, and they must remain on the vessel.

The ordinances regulating this Harbor of Refuge can be found in *Appendix B: Resources*.

SPATIAL ANALYSIS

The results of the 2021 survey, the Harbors of Refuge inventory, advisory committee feedback and the analyses of interview data were combined to develop a detailed data set of existing harbors of refuge in coastal Louisiana. We mapped Geospatial Data related directly, indirectly or potentially to Harbors of Refuge for the entire coast. The sources and data types are listed in Appendix C.

Advisory Council and Committee Input

Recommendations that emerged from the Advisory Council meetings included exploring the potential for additional data collection efforts and acquiring additional land ownership data in regions identified as potential future harbor of refuge sites. In addition, the Coast Guard offered to verify and collect information at identified existing and future harbor of refuge sites and to share information on the existing harbor of refuge LaSAFE Harbor at Empire, LA in Plaquemines Parish.

Recommendations for analysis of existing data include using Geospatial Analysis to help identify potential future harbor of refuge sites given a set of favorable geospatial characteristics. However, general characteristics of mappable features identified through the survey/interview/legal analyses would need to be defined more specifically and in some cases quantitatively (i.e., wind protection, space, shallow water). This is a recommended pursuit using spatial analysis to identify future sites.

Survey Results Applicable to Harbor of Refuge Data Collection and Decision Making

Additional considerations were derived as part of the qualitative data analysis from the survey and interviews conducted. The results include summary themes that



Intracoastal City, LA (2021)

inform acquisition of harbor of refuge characteristics supporting the development of attribute tables and descriptive data. Specific examples of features that were addressed are discussed below.

It is useful for boaters to know the proximity of a specific harbor of refuge to open water in times of impending severe storms. The travel distance from a harbor of refuge to an open water body is measured using high resolution imagery, and can include travel through streams, canals, lakes and bays. A straight line distance can also be measured to the nearest open water which would be relative to wind impact and surge. It would be helpful to develop a definition of open water in this context for consistency.

The number of pilings, their height, and composition are important metrics for harbors of refuge. More pilings can accommodate additional boats, and the pilings need to be adequately spaced to prevent collisions. The height determines the accommodation of the piling to higher water levels as taller pilings are preferred. The piling material affects the traction of the rope to the piling and the wear of the ropes caused by grating and grinding of ropes against the piling material. Wood pilings are preferred over steel and concrete. In some instances, cluster pilings are preferred because of their increased bearing capacity. Assistance from the Coast Guard or harbor of refuge owners is needed to gather these data.

The utility of a harbor of refuge is increased by the number of boat slips and the range in size (length and width) of the slips to accommodate a variety of boats and types. In addition, boat slips with finger piers help secure, moor, and protect boats and prevent them from colliding into each other during storms. The information on boat slips can be acquired using high resolution imagery in some cases; otherwise assistance will be needed from the Coast Guard or harbor of refuge owners.

Smaller boats need protection from impact with larger vessels in stormy conditions. This could be accomplished with widely spaced boat slips, tie-ups, pilings, moorings, or cleats, etc. Assistance from the Coast Guard or harbor of refuge owners would be needed to assess this information.

Shallow water in harbors is preferable because wave height is limited by shallow water. Also, if a boat is damaged or sinks, it is easier to recover. A depth in the range

Golden Meadow, LA post Hurricane Ida (2021)



of 5-6 feet is preferable. Water depth in harbors can sometimes be determined using existing topobathy data or with assistance from the Coast Guard or harbor of refuge owners when needed.

Space is an often repeated need. We interpret this to mean the availability of large areas providing wide berths from other vessels to preclude incidental contact

and damage during a storm, and also to accommodate a larger number of vessels. The concept of space will need to be rigorously defined to quantify it or appropriately describe it for effective use as a characteristic of harbors of refuge. The assistance of the Coast Guard or harbor of refuge owners would also be needed to assess the characteristics for each harbor of refuge.

Protection from wind is a desirable asset for a refuge. The presence and density of trees in the vicinity of a harbor of refuge functions as a windbreak. Other factors may also be considered such as close proximity to some structures and buildings increase the likelihood of damage from wind-borne debris. An assessment of this feature would need to be clearly defined and require assistance from the Coast Guard or harbor of refuge owners.

Additional Considerations

Numerous additional attributes of harbors of refuge are listed in Table 1. Characteristics of Harbors of Refuge that have not been itemized will require assistance to obtain this information from the Coast Guard or harbor of refuge owners.

The availability of resources and services in the vicinity of each harbor of refuge has been suggested as a potential need. These services include food, fuel, public spaces, maintenance facilities, and hotels. Some of this information can be gathered using applications such as Google Maps, but other assistance would likely be required.

Suitability analysis is a category of spatial analysis that can be employed to identify potential locations appropriate for the possible development of future harbor of refuge sites that satisfy a set of geographic and spatial criteria. See Palmetto Island Proposed Harbor of Refuge Site map as an example of criteria identified as desirable for designating Palmetto Island as a harbor of refuge. The process can utilize datasets currently assembled and other existing datasets that are identified and can be acquired. In addition, physical characteristics (as opposed to geospatial) identified as preferable for a harbor of refuge can contribute to the design and construction of future harbors of refuge following geographic siting (i.e., piling type/height, # cleats, slip size, etc.).

Maps

Additional maps of designated and proposed harbors of refuge appear in Appendix D.



Cameron Parish post Hurricane Laura (2020)

RECOMMENDATIONS AND NEXT STEPS

After speaking with stakeholders such as vessel owners, harbor of refuge officials, and others, LSG has received many informed recommendations for Louisiana's future development and use of harbors of refuge.

Outreach

- Create a Louisiana Harbors of Refuge storymap.
- To vessel owners:
 1. Identify and develop outreach products to inform vessel owners of harbor of refuge locations and the laws regarding them, and
 2. craft an effective dissemination strategy for information on harbors of refuge during storm events.
- To the Advisory Committee: Reconvene and discuss recommendations and next steps.
- To other states: Convene and share findings with other states and regional organizations, including other Sea Grant programs, NOAA Regional Team, and NOAA Marine Debris Coordinators.

Partners

- Add representatives from the U.S. Army Corps of Engineers and the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP).
- Seek Coast Guard assistance in data collection regarding design attributes of current harbors of refuge.

Engineering and Technical

- Prioritize preferred design features such as high pilings, as indicated by vessel owners.

Policy

- Prioritize state-owned lands for future sites over federal and privately owned lands.

Spatial Mapping

- Create an interactive web-based tool with harbor of refuge locations.
- Capture images to show site conditions and design, both aerially and on-ground.

- Develop a web-based tool to show harbor of refuge slip vacancies in real time.

Funding

- Identify funding to help remove derelict vessels and related marine debris.

Additional Research

- Conduct follow-up interviews regarding:
 1. harbor details;
 2. policy decision-making processes; and
 3. harbor development and designation processes

Cameron Parish post Hurricane Laura (2020)



APPENDIX A: SURVEY QUESTIONS

Outreach info - to the person primarily responsible for getting vessel to harbor ?

Are you the vessel: captain, owner, operator, other?

1. Do you have access to a Harbor of Refuge if a major storm approaches? Yes, No, if Yes (Name)
2. When you decide to move to seek refuge, what are motivating factor?
3. Factors to determine risk tolerance (wind, storm surge, etc.)
4. How do you decide where to seek refuge?
 - a. distance from where you are
 - b. amount of cover
 - c. pilings
 - d. tie ups
 - e. depth
5. Do you ride the storms out on your boat/or are you required to?
6. What physical attributes do you look for in a Harbor of Refuge?
7. How far do you travel to access a Harbor of Refuge?
8. Have you sought refuge because of a big storm before?
 - a. If yes, what factors motivated you to do so? (List)
 - i. Where did you take refuge? Where did you move from to do so? (Post map/zipcode)
 - ii. How far away was the refuge? (number range options)
 - iii. Was it your first choice?
 - iv. What attributes of the harbor?
 - v. What was your experience with port authority?
 - vi. Did you know the policies/regulations for seeking refuge?
 - vii. Did the policies/regulations influence your decisions?
 - viii. Did reception from port influence your decision?
9. How to decide to move/ seek harbor of refuge (docks stop buying, flood gates)
10. When to decide to seek/ move (how much time to move once decision

is made (if linked to gates, etc.)?)

11. Do you know when a port (port authority) is legally required to offer refuge?
12. Where fish? (filtered; mapping hotspot format)
13. Where parked/ where boat most the time (How ask, zipcode, dock name, mapping)
14. Insurance
15. Sources of information- NOAA, local, LSU CERA, Weather Channel guy (<https://cera.coastalrisk.live/>; <https://www.ventusky.com/?p=27.8;-91.9;5&l=wind-10m>; <https://waterwatch.usgs.gov/?m=real&r=la>, <https://www.nhc.noaa.gov/>)
16. What is the size of your vessel? Length, breadth, draft
17. Demographic
 - a. Age
 - b. Race/ethnicity
 - c. Time fishing
 - d. Role on boat? - targeting captains/owner/operator
 - e. Language?
 - f. Fishery?
18. Open ended- what else do you want to tell us?

St. Bernard Parish, LA (2006)



APPENDIX B: RESOURCES

Port Fourchon Ordinance No. 71 - Prohibiting Unmanned Vessels During Storms

<https://portfourchon.com/wp-content/uploads/ordinance71.pdf>

Port Fourchon Ordinance No. 74 - Storm Harbor Marina Use

<https://portfourchon.com/wp-content/uploads/Ordinance74.pdf>

Greater Lafourche Port Commission (Port Fourchon) Storm Phases

https://portfourchon.com/wp-content/uploads/GLPC_Storm_Phases.pdf

Port of Lake Charles Hurricane Plan (Contains Storm Phases and Emergency Berth Application)

<https://portlc.com/wp-content/uploads/2023/05/2023-Hurricane-Plan.pdf>



Cameron Parish post Hurricane Laura (2020)

APPENDIX C: DATA SOURCES

SOURCE OF GEOSPATIAL DATA & TYPES INCLUDED IN HARBOR OF REFUGE ARCMAP GIS PROJECT*

*An ArcMap Project is used to collect and manage a set of geospatial data. It allows the user to organize, view, edit, create, explore, symbolize and analyze geospatial data as well as create maps.

Multiple Sources

Harbor of Refuge Sites

Harbor of Refuge Characteristics
(Google Maps, Marinas.com, ArcGIS, NOAA topobathy)

USACE

Waterway Mile Markers

Locks

Docks

Principal Ports

USACE, LOSCO, USGS

Navigable Waterways

Marinas.com, LOSCO, Google
Maps

Marinas

LOSCO, Boatramp.com, Fishing.org, Google Maps

Boat Launches

Marinas.com

Anchorage

Inlets

LA DOTD

Ports deep draft

Ports shallow draft

Parish Boundaries

State Boundary

US Census Bureau

Primary, Secondary Roads

USGS PADUS

Protected Areas – Federal, State, Public Lands

LA State Lands Office

State Lands

State Water Bottoms

NOAA

Topobathy

Hurricane Tracks

NASA, USGS

Landsat Imagery

ArcGIS

Basemaps

APPENDIX D: MAPS

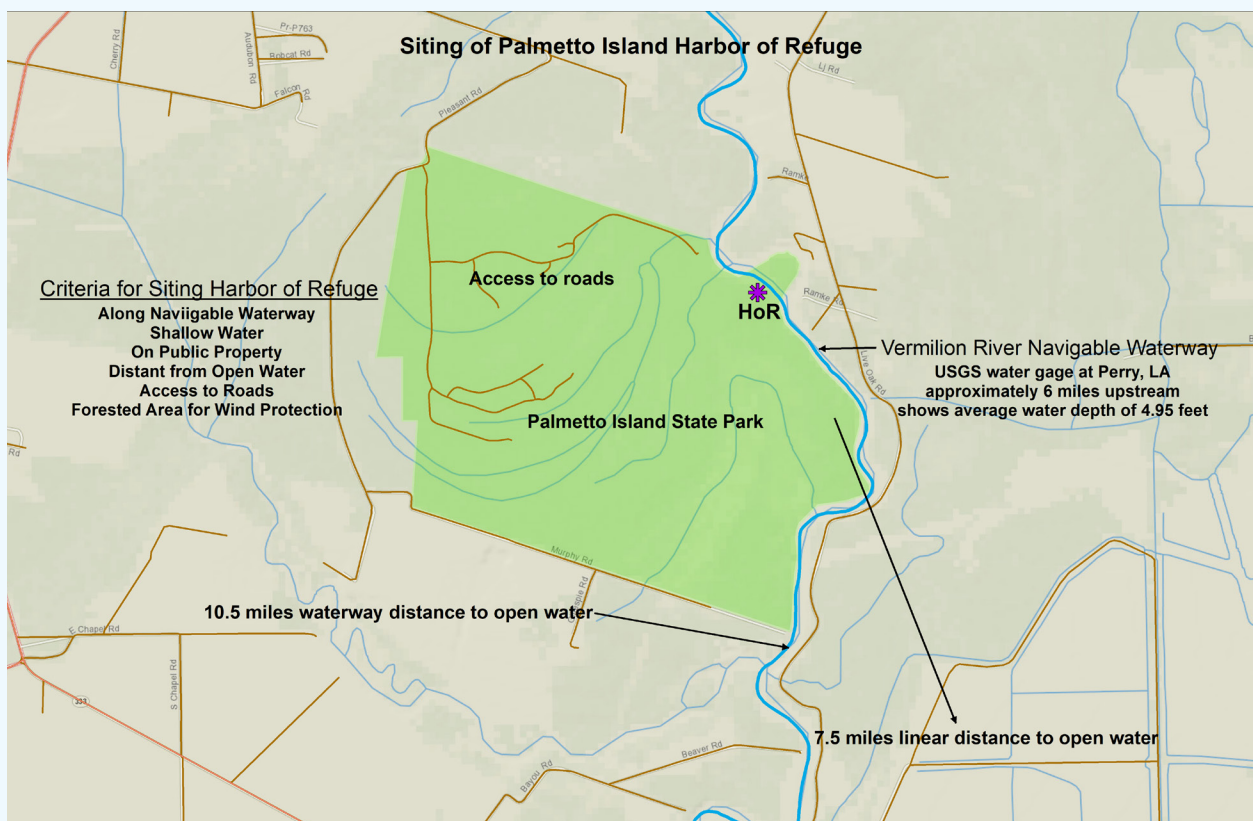
HARBOR OF REFUGE SITES IN LOUISIANA

The map of coastal Louisiana shows the location of sites unofficially designated as Harbors of Refuge, which are depicted in red. One site shown in purple is a proposed location at Palmetto Island. It has very suitable characteristics for development.



PALMETTO ISLAND PROPOSED HARBOR OF REFUGE SITE

The proposed location of the Palmetto Island Harbor of Refuge is shown in detail. As depicted on the map, the site satisfies most of the essential criteria for siting a potential harbor of refuge. Other areas with similar characteristics can be located using Suitability Analysis.



PALMETTO ISLAND LAND COVER

The zoomed-in high resolution aerial image reveals that the Palmetto Island proposed site is surrounded by forest cover. Boat owners have observed that trees provide wind protection from storms.



Services and Facilities within three miles of proposed Palmetto Island Harbor of Refuge

- Palmetto Island Boat Ramp
- Palmetto Island Campground
- Louisiana Bait Products
- Intracoastal City Drydock & Shipbuilding
- Tanner Services
- Trelleborg Marine Systems North America
- Stallion Offshore Quarters
- Gulf Coast Marine Fabricators
- Grand Isle Shipyard Abbeville
- US Coast Guard Station Abbeville
- Acadian Contractors
- Audubon Acres RV Park
- Dollar General
- Rotorcraft Leasing Company
- LA Blue Crab & Crawfish Restaurant
- Intracoastal Liquid Mud
- Hebert Marine Rental
- City of Abbeville (7 miles)



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Report available at <https://www.laseagrant.org/outreach/projects/harbor-of-refuge/>

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