



Oyster

AQUACULTURE

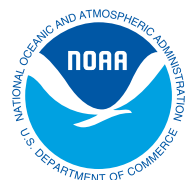
Brian Callam
Rusty Grice
Leslie Sturmer
Bill Walton
Erik Lovstrand
Natalie Simon

These fact sheets for the off-bottom oyster aquaculture industry in the Gulf of Mexico provide guidelines and suggested safety procedures in preparing for tropical storms and hurricanes:

- **Introductory Planning Guide**
- **Adjustable Long-Line Farms**
- **Floating Bag Farms**
- **Floating Cage Farms**
- **Land-based Operations**
- **Workboats**

To access all of the fact sheets in this series, visit the National Sea Grant Library at nsgl.gso.uri.edu. Using the "search the catalog" function, search "Oyster Aquaculture Hurricane Preparedness Series."

This publication was supported by Florida Sea Grant, the Mississippi-Alabama Sea Grant Consortium, and Louisiana Sea Grant.
 GOMSG-H-20-002



Tropical Storm and Hurricane Preparedness for Off-bottom Oyster Aquaculture in the Gulf of Mexico

Land-Based Operations Guide



Photo courtesy of Emily Colson, University of Florida/IFAS

Land-based oyster operations that are vulnerable to hurricanes, tropical storms, or severe weather events include seed production facilities and processing plants. This fact sheet provides guidance related to storm planning and preparation, as well as precautionary suggestions, for seed suppliers and wholesale dealers. It is part of a series providing an overview of storm preparation and planning for oyster aquaculture operations in the Gulf of Mexico region.

As the primary source of seed, hatcheries and nurseries are critical components of oyster aquaculture. These facilities are typically located on waterfront property and are at risk to coastal flooding and storm surge. Inside the hatchery, adult oysters (broodstock) are spawned to create oyster larvae that are grown in tanks and fed

cultured microalgae. Oysters complete the larval stages of their lifecycle in the hatchery and are then moved to a nursery setting to be grown large enough for the farm.

Market-size oysters are harvested and delivered by growers to a dealer's processing plant where they are washed, cleaned, sorted, packaged, and stored in a refrigerated cooler prior to distribution. Processing facilities are not necessarily located in flood-prone coastal areas but can be affected by power outages associated with high winds.

SITE SELECTION AND FACILITY DESIGN

There are several important considerations in preparing for storms through proper siting, designing, and constructing of land-based facilities. Buildings and structures used in



FIGURE 1. Filtration equipment installed on a trailer with quick disconnect and union fittings at the Louisiana Sea Grant Oyster Research Hatchery in Grand Isle, Louisiana. Photo courtesy of University of Florida/IFAS Shellfish Extension

processing shellfish must meet applicable federal and state regulations for sanitary operation; these requirements are not reviewed in this fact sheet.

- Assess vulnerability of the site to flooding and access to roads during flooding.
- Evaluate reliability of critical infrastructure (e.g., power, communications, etc.).
- Construct permanent structures to meet a minimum wind rating of 130 mph (178 km/hr) and comply with Federal Emergency Management Agency (FEMA) regulations pertaining to elevation in flood plain areas.
- Use concrete walls and metal roofing in your building design as these materials are considered the best construction option for hurricane resistance.
- Use breakaway walls for temporary structures or below elevated buildings.
- Use swales and/or berms to direct surface water flow around property and stabilize exposed soils. Criteria for surface water control techniques can be obtained from Soil and Water Conservation district offices.
- Provide adequate floor drainage in areas where tank drawdowns occur or shellfish are stored, as well as work areas that are routinely rinsed.
- Install backflow preventers to prevent contamination of potable water supply.
- Install generators with a capacity to operate critical facility components during power loss for 3 to 5 days (e.g., aerators, pumps, refrigerated coolers, etc.).
- Set up ground-level components for rapid disconnection to move inland in anticipation of storm surge or coastal flooding. For example, use quick disconnect or union fittings on pumps and filters or permanently install equipment on trailers or pallets (Figures 1 & 2).
- Maintain grounds around buildings to be free from conditions that may result in shellfish contamination, such as inadequate drainage, or accumulated shell.

- Identify alternate location(s) where equipment can be easily moved to avoid flooding and wind damage.
- Maintain access pathways to equipment that may be removed prior to a storm.

PRIOR TO HURRICANE SEASON

Prior to hurricane season, seed suppliers and wholesalers should take steps to reduce the risk of losses.

- Develop and review a storm plan detailing personnel responsibilities and chain of command, primary and emergency contact information, and equipment evacuation designations based on storm strength (i.e., what gets removed from the site when a storm gets to a certain strength).
- Inform employees that if a storm approaches, they will be needed to prepare and implement the storm plan.
- Have a plan for assessing employees' availability after the storm.
- Develop and review a post-storm recovery plan including contact information and procedures, relevant local emergency and government contacts, insurance contact information and claim procedures, etc.
- Obtain civil defense or other identification documents for essential personnel to immediately return after an evacuation.
- Purchase and maintain a stockpile of storm preparation supplies (e.g., tarps, plywood, sandbags, etc.).
- Identify an inland off-site storage location that is accessible and able to receive equipment.
- Make sure generators are in working condition and fuel reserves are adequate.
- Clean up loose items around buildings and structures to reduce storm preparation workload.
- Have employees conduct at least one timed run-through of preparation activities to gauge the amount of time needed to implement the storm plan.
- Maintain inventory of oyster stocks to be able to quickly review needs during hurricane season.

DURING HURRICANE SEASON

A tiered approach to preparation, which has been adopted in each fact sheet, allows seed suppliers and wholesalers to stage tasks based on the storm or hurricane's track forecast. The authors developed the following color codes to address increasing levels of concern and actions.

CODE YELLOW

Once a hurricane or tropical storm has formed in the Gulf of Mexico or has a chance of entering the Gulf, it is time to begin preparations according to the facility's plan. Note that the timeline is fluid and will depend on the storm's speed and track.

- Re-check that all employees have received the storm plan and emergency contact information.

- Check that storm preparation supplies, including generator fuel reserves, are adequate and easily available.
- Document the pre-storm condition of the facility and equipment with dated photographs and notes.
- Make sure the off-site storage location is ready for receiving equipment and remove items that are not necessary for continued operation.

Hatchery and nursery facilities:

- Inventory and prioritize in-house larvae, post-set, seed, and broodstock. For example, larvae are the least expensive to produce, so efforts may be minimal in securing these stocks.
- Purchase algal concentrates that can be used to feed oyster stocks if algae cultures crash.
- Keep several bags of synthetic sea salt or rock salt on hand as storms can result in excessive rainfall, lowering salinities of inshore waters.

Processing plant:

- Inventory in-house product and pending oyster purchases and sales.
- Prepare to ship out orders sooner than the normal distribution schedule.
- Notify suppliers of the storm plan so shipments do not arrive at your facility.

CODE ORANGE

Once a hurricane or tropical storm watch has been issued, final preparations should begin. In the case of a fast-moving



FIGURE 2. Filtration equipment installed on a pallet with quick disconnect and union fittings at the Louisiana Sea Grant Oyster Research Hatchery in Grand Isle, Louisiana. Photo courtesy of John Supan

storm, proceed with tasks associated with final stages of preparation.

Hatchery and nursery facilities:

- Prepare generator for operation in the event of power loss or evacuation.
- Perform routine cleaning of systems that will be maintained in the hatchery through evacuation (e.g., algal stocks, broodstock holding/conditioning system, etc.).
- Add broodstock not held in conditioning or holding tanks into these systems or return them to the farm.
- Move or prepare to move spare pumps, filters, hoses, and other items to secure storage location (based on predicted storm strength, items may be stored onsite or at an inland location).
- Fill empty tanks onsite at least half full of water to prevent moving from wind or flooding. Place loose gear inside the tanks.
- Secure outdoor raceways and weller tanks with rope, straps, or bungee cords to the tank support system.
- Move nursery drum silos and FLUPSY wellers to higher ground or inland site.

Processing plant:

- Locate an alternative storage cooler for remaining inventory or load into a refrigerated truck or trailer if required temperature can be maintained.
- Remove all shell and other materials that may spoil from the facility and grounds to prevent attracting pests and vermin.

CODE RED

When a hurricane or tropical storm warning has been issued, final preparations must be concluded if and only if they can be accomplished safely. A series of personal risk assessments must be made.

If the facility is not able to withstand predicted wind speeds or storm surge, vital equipment should be removed and transported to a designated inland location for safeguarding.

Hatchery and nursery facilities:

If your hatchery can withstand predicted wind speeds and storm surge, conduct the following activities to reduce losses until employees can return to the facility.

- Feed broodstock oysters heavily, and make sure broodstock sumps are full of seawater.
- Drop the water volume of larval tanks and feed extra algae.
- Swirl any stock algal cultures and transfer darker cultures.
- Drain seawater lines and fill with freshwater if time permits.
- Activate recirculating systems if the facility has the capability to do so.
- Confirm the generator is operating and all critical equipment are connected.

- Hook up a small single-phase blower to the generator to provide aeration to tanks containing oyster larvae, post-set, and broodstock.

If the nursery is vulnerable to storm surge and coastal flooding, conduct the following activities to reduce losses of seed and equipment.

- Shut off electricity to pumps and nursery facility at the breaker box.
- Pull and secure pumps so they do not become submerged.
- Store nursery seed in seawater-dipped towels or drain sock material and place in a cooler to keep damp and cool. Within 2-3 days, seed will need to be placed back into the water.
- Transport nursery seed (if feasible) to another in-state growing area that likely will not be affected by the storm event.
- Stock nursery seed large enough into small mesh (2 mm) bags and secure on farm with other culture gear.

Processing plant:

- Document storage temperature of cooler (if product remains onsite) with a recording thermometer device, such as Thermapen Blue®.
- Sandbag the cooler and exterior doors to minimize storm surge or flood waters from entering the building.
- Transport inventory via refrigerated truck or temperature-controlled trailer to a predetermined location that is less likely to experience flooding and extended power outages.

POST-STORM RECOVERY

Seed suppliers, wholesalers, and their employees must be ready to take care of the needs of the land-based facilities as soon as it is safe and reasonable to do so. After the storm has passed, the following tasks should be considered.

- Assess risk of returning to the facility and proceed only when safe.
- Notify employees to return to the site for post-storm maintenance and activities.
- If damage occurred, document condition of facility and equipment with dated photographs and notes.

- Return all equipment from alternative off-site storage location.
- Communicate with buyers to provide situation and outlook reports.

Hatchery and nursery facilities:

- Return water flow to tanks stocked with oysters as quickly as possible.
- Drain, clean, and refeed tanks as soon as clean seawater is obtainable.
- Create a brine with synthetic sea salt or rock salt and add to static tanks to increase salinities if necessary (this is a temporary measure until incoming waters return to normal salinities).
- Assess and document oyster survival and condition.

Processing plant:

- Take photos to verify the status of the facility in case the local shellfish plant inspector is delayed from visiting the facility.
- If the facility was not flooded, inform the plant inspector and continue with business as usual.
- If the facility was flooded but waters did not reach the cooler and power was not interrupted, clean and sanitize flooded areas and inform the plant inspector. If product is remaining in the cooler, distribute after inspection.
- If flood waters permeated the cooler or power was disrupted and shellstock remaining in cooler exceeded critical temperature limits in the Hazard Analysis Critical Control Point (HACCP) plan, then product is adulterated and must be properly disposed.
- Check with the inspector to find out if potable water at the plant must be tested prior to reopening.

ACKNOWLEDGMENTS

Scott Rickard (Auburn University Shellfish Lab), John Supan (oyster hatchery consultant), and Florida Department of Agriculture and Consumer Services contributed input for this fact sheet.

This fact sheet is the result of a collaborative effort among shellfish aquaculture extension specialists in the Sea Grant programs of Florida, Mississippi-Alabama, and Louisiana. For further information, contact:

LESLIE STURMER

University of Florida/IFAS Extension
Phone: 352.543.5057
Email: Lnst@ufl.edu
<http://shellfish.ifas.ufl.edu>

BILL WALTON

Auburn University Shellfish Lab
Phone: 251.861.3018, ext. 2
Email: billwalton@auburn.edu
<http://sfaas.auburn.edu/shellfish-lab>

BRIAN CALLAM

Louisiana State University
Phone: 225.578.6527
Email: bcalla3@lsu.edu
www.laseagrant.org/outreach/oyster-research-lab

The views expressed herein do not necessarily reflect the views of any of these organizations.

The information and checklists provided in this series of fact sheets are meant as guides only. Following these guidelines and suggested safety procedures does not assure that damages will not occur to oyster crops, gear, or facilities.