CLEMSON EXTENSION

AQUACULTURE FISHERIES & WILDLIFE

AFW 12 September 1997

Aquaculture Natural Disaster Preparation and Recovery

Natural disasters are random acts of nature that occur without pattern. Often it is the suddenness and randomness that are their most devastating qualities. Scientists trying to make order out of this chaos try first to identify and then track patterns and causes of natural disasters. We have learned to pay attention to certain signals and warning signs. Meteorologists have identified tornado and hurricane seasons and developed sophisticated ways to track and gauge the magnitude of storms within them. By comparing water levels in water bodies as they change during rain storms we are able to predict an approaching flood. Even with these prediction capabilities, there is always a level of unpredictability. Flash floods occur out of season and tornadoes choose there own paths.

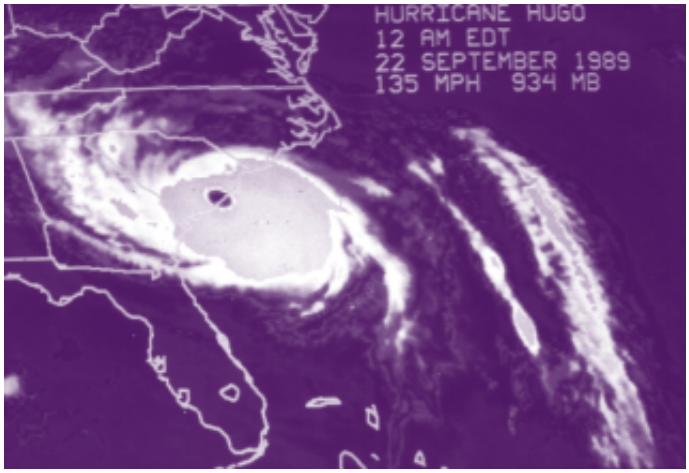
Because aquaculture is so heavily dependent on reliable natural resources like water, the possibility of major catastrophes to aquaculture during natural disasters should be considered. Farmers should prepare for natural disasters through:

1. Proper facility construction
2. Developing a disaster management plan
3. Having emergency backup equipment on site
4. Contacting power companies to get on a service priority list
5. Considering insurance options to provide some disaster relief.

In South Carolina some important natural disasters which may affect aquaculture include floods, droughts, tornadoes, or hurricanes.

PREPARATION THROUGH PROPER FACILITY CONSTRUCTION

Levee-type ponds, watershed ponds, and aquaculture facilities in coastal regions require different construction and disaster-management approaches.



Levee-type ponds

Water to fill levee-type commercial fish production ponds may come from wells, springs, streams, and reservoirs. One of the first considerations for drought preparedness and general production management is to select a site that has an adequate supply of good quality water. Levee-type ponds receive little runoff and a well usually provides all production water. The amount of water needed depends on farm size. A well that provided a minimum of 25 gpm per surface acre is recommended. A spring is nearly as good as a well but may dry up during droughts. Streams and reservoirs are not recommended because they are greatly influenced by drought conditions and may not be a reliable source of water. They may also become contaminated with pesticides or industrial wastes when passing through property owned by another. Their use may also result in introduction of unwanted wild fish and their diseases.

Soils used for levee-type pond construction must hold water so drought conditions are not exacerbated by leakage. Clay soil types with at least 20% clay are best for pond construction.

Levees should be compacted and a vegetative cover established to reduce pond bank erosion and failure during major storm events.

Pond site selection must include consideration for drainage. The lowest part of the pond must have a higher elevation than the ditch that drains it. Consider that your drainage ditch may be full of flood water at the time you most need to drain your pond. Establish the volume of other water sources that may enter into your drainage system and make adjustments accordingly.

Many farmers use outside drains. The inside ends of these drains are 5-10 feet from the levee toe and covered with screening. The outside end should be 5 feet past the toe and fitted with a "T." The height of the standpipe on the "T" sets the water level within the pond and releases excessive water from rainfall while preventing flood water and wild fish from entering from the drainage ditch.

Watershed-type ponds

Much of South Carolina is hilly and levee-type ponds are not practical in these situations. Watershed-type ponds take advantage of runoff from rainfall on the watershed. Wells, springs, streams, and reservoirs are sometimes the only source of reliable supplementary water. Watershed-acreage to water-surface-acreage ratios vary from 5 to 1 for land with heavy clay to 30 to 1 on porous soil and wooded sites. Ponds normally fill during the rainy months but should not drop more than 2 feet during drier months. During periods of drought keep ponds as full as possible. Ponds should be constructed in soils with at least 20% clay so that leakage is minimized. Floods from nearby rivers should not be allowed to overflow into the ponds. Information on 100-year flood potential may be acquired from National Resource Conservation Service. Floods from within the pond's watershed should not overflow the dam and cause danger to the structure. An overflow pipe connected to a "T" should be able to handle excessive flows of water that may occur during storms. The top of the overflow pipe should be 3 feet below the top of the dam and 1 foot below the top of the spillway. Water should not run over the top of the dam because it may erode down and cause dam failure. To prevent erosion and dam failure, a grassed earthen spillway is needed to remove water during major rainfall events. The size of the spillway depends on watershed size, slope, vegetation, and soil type as well as expected rainfall intensity. Large watersheds with large ponds will require large spillways. Horizontal bars may be placed in spillways to prevent fish from escaping. The bars will require frequent cleaning to prevent clogging from floating debris.

Secondary problems with watershed ponds and solutions

Because watershed-type ponds generally have greater depth, summer stratification may occur. This happens when the pond bottom has cooler, more dense water with low levels of dissolved oxygen. The surface water is warmed by the sun, is more buoyant, and contains high levels of dissolved oxygen. Problems occur when the two layers mix. This is sometimes called "turnover." Mixing occurs when the surface water is cooled, becomes more dense, and sinks to the bottom. Surface waters are often cooled by cold rain storms or hail. Strong winds may also cause this mixing and "turnover" to occur. During turnover, the oxygen concentration throughout the whole pond is diluted because of the mix of oxygenated surface water with bottom waters that are without oxygen. In addition, organic matter and metals near the bottom of the pond will further deplete available oxygen. Large, disastrous fish kills may occur with turnovers but may be avoided or lessened with proper preparation and management. Having emergency aeration available may save fish if a turnover occurs. If ponds are very deep and stratification is expected, mixing with a paddle wheel aerator or a circulator may reduce stratification and avoid "turnover" problems.

Several consecutive days of cloudy weather may cause algal blooms to die "crash" and stop producing oxygen. In addition to the lack of oxygen production by algae, bacteria feeding on the dead algae will consume even more dissolved oxygen. The effects of this natural disaster may be lessened by having plenty of supplemental aeration available for these events.

It is important to check dissolved oxygen levels frequently during summer and early fall when there are several consecutive days of cloudy weather.

Coastal Regions

If you are practicing aquaculture on public coastal lands such as growing clams, oysters, or practicing cage culture, the cages or pens should be secured prior to major storms. They should be moved temporarily to highland areas and secured. They may also be moved to deeper water areas which do not have as great of wind and wave action.

Water control structures should be adjusted to remove surface water which can be added if a tremendous amount of rainfall is expected. If tidal water is used to flush and fill ponds and there is potential for outside waters to enter ponds during flooding, farmers should increase the level of the boards within their water control structures to control the influx of flood waters. If possible, farmers should close the outside entrance into the pond so that flood waters do not enter their production facilities.

In coastal regions, hurricanes can be devastating to aquaculture operations. Prior to hurricanes, any equipment which is easily transportable and any noncritical equipment should be moved to safer places which are on higher ground. Many aquaculture facilities have large bulky items which are not easily moved, such as above-ground tanks and raceways. These items should be filled with water to reduce destruction by wind and flooding.

Problems associated with floods and some solutions

Problem: Flooding due to heavy rainfall, tidal alteration, or storm surge may:

1. Cause the loss of your aquaculture product from the confinement facility,
2. Introduce predators or competing species into your operation,
3. Result in disease introductions.

Solution: Lower water levels in culture facilities if a flood is expected. If water levels must be lowered, reallocate fish to maintain appropriate biomass so that waste assimilation capacity of the pond is not exceeded. It is also advised to reduce or cease feeding if a power outage is expected since uneaten food and fish wastes cause a decrease in dissolved oxygen levels.

Wetlands

Do not build ponds on wetlands. It is illegal in most situations, and you may lose most of your fish production because wetlands are subject to periodic floods. If your site is not on a designated wetland but near one, it may also be subject to periodic flooding. Check with the local U.S. Geological Survey Office or Soil Conservation Office to evaluate your pond site for flooding potential.

EMERGENCY BACKUP EQUIPMENT

Emergency equipment requirements will vary with type of culture operation and should be placed where a storm will not destroy or impact their operation. Generally, a backup power generator and emergency aeration equipment are desired. The size of each is dependent on poundage of fish in the facility and the degree of risk you are willing to take. The generator should be sized to provide your aerator and pumping requirements plus 20%. All emergency backup equipment should have a regular maintenance schedule and be tested for operation prior to arrival of the storm seasons. Make sure all equipment has been fueled and lubricated. Emergency aerators may be run off tractor PTO units and provide some relief to deoxygenated ponds when short-term power outages occur. Farmers may need to rent portable generators to continue the aeration of the ponds.

Farmers should always store fuels, chemicals, pesticides, and therapeutics in safe places to prevent spills which could cause major disasters in production areas.

PRIORITY LISTS WITH POWER COMPANY

Farmers should inform the local power company of their critical need for power. All power companies within the state maintain priority lists for the reacti-

vation of power after natural disasters. The priority lists include hospitals, emergency preparedness agencies, and law enforcement groups. Since electricity is critical to aquaculture and massive crop loss can occur without power, you should make sure you are added to such a list prior to a power outage.

INSURANCE

Farmers should sign up with government and/or private insurance companies. Both the U.S. Department of Agriculture (USDA) Farm Service Agency and private insurers presently have risk insurance for aquaculture effected by natural disasters. To sign up for government aquaculture crop insurance with the USDA Farm Service Agency, you should visit the local USDA Farm Service Agency in your county. You must register for the Non-insured Crop Disaster Assistance Program (NAP) by July 1 of each year. NAP does not provide coverage at as high a rate as Buy-Up Insurance companies do for insured crops. Also, special conditions must be met for a natural disaster to be declared. NAP will pay only 60% of the value of the loss after the loss exceeds 50%. The Farm Service Agency is attempting to cover aquaculture as an insured crop with higher coverage in the future. The farmer will need to know pond acreage, past production yield, and the exact location of the farm. USDA crop insurance covers only private lands. Any individual practicing aquaculture on public lands such as shellfish farming should contact a private insurer. A list of private insurers can be obtained from the Extension aquaculture specialist for your state or through a county Extension agent.

The aquaculture industry can be dramatically affected by natural disasters. Because natural disasters are unpredictable and temporary in nature they present short-term management problems that can be devastating if not properly prepared. We recommend:

1. Consider natural disaster potential when choosing a site and constructing facility.
2. Develop a disaster management plan that will work for you.
3. Locate backup equipment and verify its operation.
4. Notify utilities of your critical demands.
5. Consider crop insurance.

Prepared by William R. English , Jack M. Whetstone and Thomas E. Schwedler, Extension Aquaculture Specialists

6888