NRAC Publication No. 220-2013

Northeastern Regional Aquaculture CENTER
University of Maryland, 2113 Animal Science Building
College Park, Maryland 20742-2317
Telephone: 301-405-6085, FAX: 301-314-9412
E-mail: ssadams@umd.edu Web: http://www.nrac.umd.edu

Dead and Dying Shellfish: What to Do?

Gef Flimlin, Rutgers Cooperative Extension, Toms River NJ
Dale F. Leavitt, Roger Williams University, Bristol RI
Roxanna Smolowitz, Roger Williams University, Bristol RI

Introduction

The nicest part about growing shellfish occurs when the water flows, it's full of phytoplankton, the weather is cooperating, the clams or oysters are growing well, fouling is not too bad, the customer market is great, and survival is fantastic.

Get real!!!

It doesn't always happen like that, and when things go bad, they can go bad quickly. Regardless if it is in an upweller, a raceway, a mesh bag, on a rack, in the bottom, or on the bottom, or in a floating cage, shellfish mortality can be a nightmare for the hatchery operator or grower.

Most often there is little hint that something is going wrong until there are significant numbers of dead or dying shellfish. But what to do about it is something the grower must understand, and do quickly, before the problem spreads through the rest of his crop, or his neighbors'.

Unexplained mortalities can be a most perplexing situation. Sometimes the entire crop will die and sometimes only a portion located in a few upweller silos or raceways will experience problems. Sometimes product in a part of a field planting will suffer while the rest is okay. Sometimes high rates of death will occur slowly, over the course of the season.

The grower usually has little information from which to make a conclusive decision as to what caused the problem. And many times doesn't know to whom to turn to figure out what the actual cause was.

This fact sheet is designed to try to improve the forensic process so that dead or dying shellfish can be examined by an expert. They will help diagnose the problem, make some suggestions on how to remedy the problem for the remaining shellfish, and hopefully improve culturing techniques to reduce the possibility of this from happening again. This fact sheet isn't designed to go into all the issues that might cause mortalities, but only how to find out what is going on.

Dead and dying clams in field plantings, with QPX disease. Photo by Dale Leavitt.

The process

Once the hatchery operator or grower has realized a problem, what should be done?

The first thing would be to contact a professional who can assist. An Aquaculture Extension Agent or Specialist would be the best first choice since they will be able to help you identify important data to gather and will help with the next steps (a current list is at www.nrac.umd.edu/Contacts/index.cfm). Aside from that, going straight to the list of laboratories that can analyze the dead or dying shellfish would be the wisest choice. (A list of labs is at the end of this publication) Making the arrangements to drive or ship your shellfish to the lab will be the first order of business.

The second thing, especially if this is a field issue, is to talk to other growers to see if they are having similar problems. No one wants to look as if they don't know how to grow shellfish, but it would be much worse if whatever you had infected your neighbor's crop too. Even hatchery operators ought to compare notes periodically to see if a certain problem exists in the local area or it is only at one place.

Documenting what's going wrong

Sampling the shellfish to monitor the extent of the problem.

It is a good idea for the culturists to take random samples of shellfish seed, from 6 to 8 places on their farm or the affected bags/plots, perhaps in total counts of 60 to 100 individuals. The farmer should note the signs of the disease (gaping, poor growth, watery tissues, rings on the inner shells, etc.) and count those that fall in the diseased category, out of the 100 taken. This should be done daily for a few days in several places around where problems are occurring, and in places where it may not be occurring, to determine what the extent of the problem is and to see if it starts up elsewhere in the system. Animals could be stressed or infected in several locations, but only currently dying in one. Samples can be taken from different silos in the same upweller bin and from different bins, or raceways.

Examine the samples for signs of disease daily.

Selecting animals for shipment to a laboratory:

Acquiring specimens for analysis and how they are to be handled or preserved may be decided by the lab to which the shellfish are being sent, and growers should always follow those directions.

For disease diagnosis, samples should consist primarily of moribund (dying or at least not in optimum health) animals with some relatively normal animals for comparison. Thirty to 60 animals (depending on the lab and the severity of the disease) in various stages of disease should be selected for submission. Moribund animals are the best samples to send and are those animals that best exhibit the signs of disease (mild gaping, poor growth, etc., depending on what your animals are showing). However, these moribund animals must still be alive and not just shells with rotting tissue.

These samples should be placed in a bag or sack and then in an insulated appropriate sized container (a cooler is best) with frozen ice packs. The bag or sack must be marked clearly with date, time, and location from where it was taken. The animals should not be allowed to rest in either fresh water (from melting ice) or salt water.

Simple visual inspections of changes in meat quality or shell deformity may help determine a problem. This photo shows abnormal conchiolin deposits, characteristic of mortality caused by ROD (JOD), on the inner surface of the oyster shell.

Preserving the samples for shipping and analysis

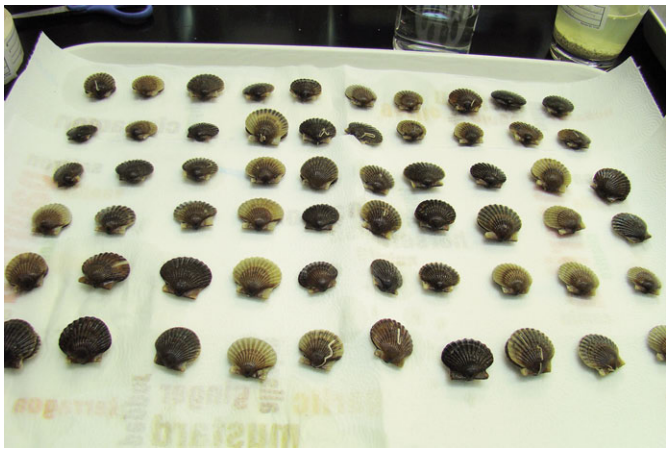
If your problem is seed mortalities, there are several ways these can be packed for delivery or shipping to the laboratory. Generally, when sampling seed, the number of animals selected and shipped is double the amount you would send as juveniles or adults. Again, follow the guidelines presented by the diagnostic lab with which you are communicating.

Samples can be put into plastic zip-lock plastic bags, kept cold in the refrigerator and then packed with chill packs or some ice for driving. Make sure the animals never sit in melted ice or in salt water during this process. It is most appropriate to wrap the bags in newspaper so that chill packs keep them cool but not too cold. Never freeze the animals. Freezing destroys the tissue integrity and results in poor ability to evaluate the disease effects on the animals. (Freezing is an option if the laboratory is going to do molecular (PCR) testing instead of histological analysis, but usually the laboratory will want to collect and freeze small pieces of the animals themselves, so the grower should still contact the lab for help first before freezing anything)

The lab may also require you to take a water sample, or samples, from a few days bracketing your sample. Make sure these are well marked with your original information about temperature, salinity, etc., and exactly where they were taken (and kept refrigerated if plankton or bacteria are being evaluated).

Growers may occasionally be directed by the laboratory to use a fixative on the animals before sending them to the laboratory. The most commonly used fixatives are Davidson's Solution or 10% formalin in sea water. Before placing in the fixative, the animal shells should be gently cracked, if they are seed sized, or the muscle should be cut, if adult. This allows the fixative to come in contact with the shellfish tissue. If very small seed are being sent (less than 3 mm in shell height, the animals can be put directly in fixative without cracking or cutting. Once in fixative, the animals do not need to be refrigerated. However, shipping animals in fixative is expensive (they must ship using special hazardous methods, so check with your shipper). These methods should only be used if the culturist is directed to do so by the receiving laboratory. Call the laboratory and your extension contact to discuss the methods with them.

When either shipping or hand delivering the specimens, good lines of communication must be established. The laboratory personnel should be contacted and an arrival date and time should be arranged. If shipping, the animals should be delivered within 24 hours (overnight shipping) and the culturist should have arranged the sample submission with the laboratory before shipping occurs. Giving the lab a tracking number for the delivery is also recommended.



Bay Scallops ready for diagnostic processing. RWU Aquatic Diagnostic Laboratory.

Documenting much needed information

To help the laboratory and the extension agent determine the cause of the disease, numerous pieces of information will be needed. Therefore, think about these issues. We highly recommend documenting these items as a standard practice. Hatchery/nursery/ growout histories are written and not just "remembered."

- What were the recent environmental conditions? Water temperature, rainfall, dissolved oxygen, changes in pH or salinity?
- When was the last time you checked these things?
- How often do you check these things?
- Do you do it on a consistent schedule? (Starting to see the reason for keeping this data?)
- Changes in food consumption for hatchery stocks, not for field plantings. Has the hatchery operator changed strains of phytoplankton for feeding newly post-set?
- What other biological issues might be going on? Are there any reports of fish kills in the area, or maybe hazardous material or sewage spills?
- What is the current condition of the animals? All dead? Some still alive? Shells empty or meat left in some? What percentage of the crop is affected? Is it all over or just in one or a few isolated containers or areas?
- Did you take any water samples in case there is something noxious in your water?
- Is there any facility (state or university field station) nearby that also keeps water quality data on a regular basis that could be checked for any strange changes?
- If this is shellfish seed dying, is it yours or did you purchase it from another hatchery. What is that hatchery? Have they experienced any mortality with their plantings or with others to whom the seed was sold?
- What is the broodstock of these seed? Are these disease resistant strains? Are they diploid or triploid?
- How long have they been in this upweller? raceway? field planting?
- Have you ever experienced other unexplained mortalities similar to this in the past? How long ago?
- Have you noticed any strange changes in water color or clarity recently? Have you noticed any strange algal blooms either by eye or under the microscope?

Specimens being processed in a diagnostic laboratory.

Refer to "Recordkeeping for Aquaculture Operations", NRAC Fact Sheet 291-2013. Use this to keep track of things that happen on your farm so that if something happens, you might be able to refer to your data to help solve the problem.

Shipping or delivering samples

These should go either by overnight shipper or hand delivered. If shipped, be sure to add some extra bubble wrap or packing noodles to the inside of the insulated cardboard box with the chill packs.

A WORD TO THE WISE

Many hatchery operators will monitor water parameters very closely during the spawning process, but once that is finished, maintaining environmental data about the site may fall behind.

Daily temperature and salinity readings are easy to do. Dissolved oxygen readings require some more sophisticated (expensive) equipment, but the investment in a DO meter for a hatchery can yield good information, especially if the site is less than optimum. Some meters also measure other parameters at the same time. Keeping track of rainfall in the area can be productive since it may be related to changes in salinity. This in turn could correlate to low phytoplankton production since rain events can lower water temperatures and the cloud cover can impact photosynthesis of the naturally occurring algae on which the shellfish feed, impacting their growth and survival.

Diagnosis results

How long should it take to get an answer? The lab to whom you bring or ship the shellfish will likely give you an idea as to when they will have some kind of answer for you. Some techniques take a few days, but other tests may be a few weeks. Most people in these labs have been involved with the shellfish industry for a long time and they know how much you need an answer. They also know that if this is field mortality, it could be something that could spread to other growers. So a diagnosis is needed especially fast.

What to do in the meantime?

Stress of the shellfish in your system can aggravate the situation. You want to give the animals the best chance they have to fight through the problem. In the hatchery, reduce densities in upwellers or raceways. In the field, reduce densities in your field plantings, don't cross contaminate sites or containers with other gear, and don't move your animals to an alternate location. That action may just spread the problem around.

Also re-evaluate all the parts of your system to see if there is something that is not typically visible that might be contributing to the problem. Check the pumps, the water source, ask again about hazardous material spills, talk again with other growers, and keep thinking of issues that could be considered. You will know more about your system than a lab will and whatever guidance you can provide will be much appreciated.

What is the cost?

The cost of analysis and diagnosis of the mortalities will vary with the problem and the number of tests required to be run. If a full histopathological analysis is needed, the cost can be between $400 to $1,000 for 60 animals. The people at these labs have been dealing with shellfish for enough years that they may be able to diagnose the problem without many tests. However, when a grower's crop is in jeopardy and may lose a year's production, getting the right diagnosis quickly so that evasive measures can be taken, may overshadow the potential costs.

Labs to Contact

Maine
Cem Giray
Kennebec River Biosciences
41 Main Street
Richmond, ME 043576 USA
Phone: (207) 737-2637 x207
cgiray@kennebecbio.com

Rhode Island
Roxanna Smolowitz
Aquatic Diagnostic Laboratory
Roger Williams University
One Old Ferry Road, Bristol, RI 02809
Phone: 401-254-3299
Cell: 5085660379
rsmolowitz@rwu.edu

Connecticut
Inke Sunila
State Shellfish Pathologist
CT Department of Agriculture, Bureau of Aquaculture
PO Box 97
Milford, CT 06460
Phone: (203) 874-0696
dept.agric@snet.net

New York
Bassem Allam
Marine Animal Disease Laboratory
School of Marine and Atmospheric Sciences
Stony Brook University
Stony Brook, NY 11794-5000, U.S.A.
Phone: 1 631 632 8745
Fax: 1 631 632 8915
http://www.somas.stonybrook.edu/~MADL

New Jersey
Lisa Calvo
Haskin Shellfish Research Laboratory
6959 Miller Avenue
Port Norris, NJ 08349
Phone: (856) 785-0074
Cell (609) 440-4560
calvo@hsrl.rutgers.edu

Virginia
Ryan Carnegie
Shellfish Pathology Laboratory
Dept. of Environmental and Aquatic Animal Health
Virginia Institute of Marine Science
1375 Greate Road, P.O. Box 1346
Gloucester Point, Virginia 23062
Phone: 804.684.7713
carnegie@vims.edu

Acknowledgments

United States Department of Agriculture

National Institute of Food and Agriculture

This work was conducted with the support of the Northeastern Regional Aquaculture Center, through grant number 2010-38500-21074 from the National Institute of Food and Agriculture (NIFA), U.S. Department of Agriculture. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.