LOBSTER

GKINS
LOUGHLIN
RINCE

PRODUCED BY
THE LOBSTER INSTITUTE
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MARINE ADVISORY PROGRAM
AT THE UNIVERSITY OF MAINE

DEDICATION

This manual is dedicated to
the memory of **Martin Kaneps**,
biologist at Clearwater Fine Foods
in Clarks Harbor, Nova Scotia,
for his invaluable contributions
to lobster health.

LOBSTER HEALTH MANUAL

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CONTENTS

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Red Tail (Gaffkemia)

1

Red tail (gaffkemia) is a fatal bacterial disease of the lobster (Homarus americanus) caused by the bacterium *Aerococcus viridans*. A lobster will contract this disease only if there is a wound or break in its shell through which the bacteria can pass. Even chewed antennae, the wound from a claw plug, or rough handling can provide an opening for the bacteria to enter. Gaffkemia often causes high mortalities among lobsters held in pounds or cars in Maine and the Maritime provinces, resulting in severe economic losses.

The bacteria are always present in lobster populations, with an average of 5% to 7% reported in freshly caught lobsters (Stewart *et al.* 1966 and Vachon *et al.* 1981). Problems with this disease are magnified in the crowded living conditions of a "live car" or pound, since the lobsters are aggressive and chew on each other, opening wounds where the disease-causing bacteria can enter. The large amount of handling that occurs in the pound also greatly increase the lobster's susceptibility to red tail.

In a car, the spread of red tail is a function of how many of the infectious bacteria are in the water and the number and size of wounds on the lobster. When a lobster dies of red tail and is torn apart by other lobsters, millions of bacteria are released into the water in the car. To prevent massive numbers of bacteria from being released, check the car frequently, at least daily, and if possible, remove weak and dead lobsters before they can be cannibalized.

How to Control Gaffkemia in Lobster Pounds and Storage Cars

Importance of Water Circulation on Aeration

Good water circulation within the car is important. Fresh seawater coming into the car provides highly oxygenated water to the lobsters and can help flush out recently shed red tail-causing bacteria from newly cannibalized, in-

fected lobsters. Any fouling that could limit water circulation within the cars should be removed.

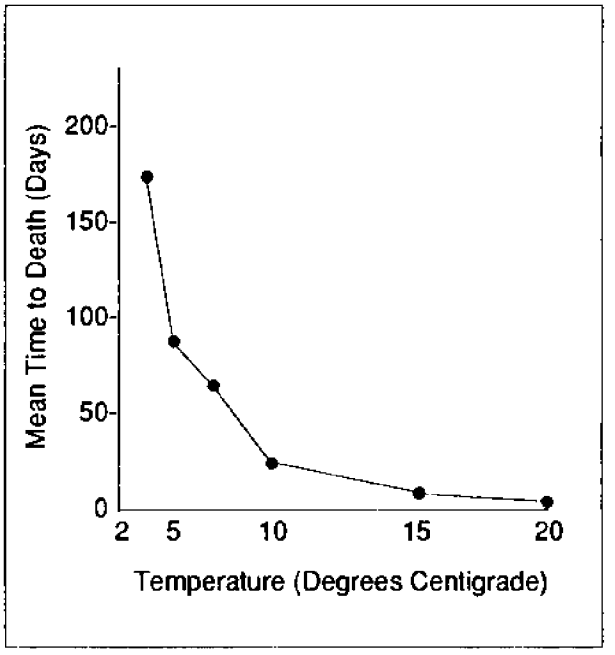
In a pound, mechanical aerators increase lobster survival time by raising oxygen levels. Oxygen concentration tends to stratify, with the lowest level occurring in the bottom few inches of the pound. This is especially true towards the end of low tide. Warm water aggravates the situation because the water holds less oxygen and lobsters use more oxygen under these conditions.

By mixing and oxygenating water, surface aerators will uniformly distribute oxygen to the entire population, helping to reduce mortality and enhance lobster food consumption and weight gain. Approximately 3 horsepower of aeration is required per acre at peak demand (Hagopian *et al.* 1989).

The Effect of Temperature on the Spread of Gaffkemia

The later in the fall you place lobsters in the car, the fewer problems with gaffkemia you will encounter. Water temperature is a critical factor determining the duration of the lobster's life after it is infected with red tail (Stewart et al. 1969) (See graph). At a water temperature of 59° F (15° C), lobsters will have an average time to death of 12 days while at 50° F (10° C) average survival is 28 days. As water temperature drops, the average life span of an infected lobster increases (65 days at 45° F (7° C) and 172 days at 37° F (3° C). As water temperature approaches 32° F (0° C), lobsters will live many months.

Even at low temperatures, when lobsters live for long periods of time, they still have the disease. If the lobsters are placed in an environment where the temperature is elevated (i.e. in shipping or in a recirculating tank), their time to death is shortened.



Effects of temperature on the mean time to death of gaffkemia-infected lobsters.

Temperature Guide

As a guide to fall temperature decline, here are sea surface temperatures recorded at Boothbay Harbor, Maine, by the state's Department of Marine Resources in fall, 1991:

	SEPT	OCT	NOV	DEC
F°	57.2	53.0	48.1	42.8
C°	14.0	11.7	8.9	6.0

Precautions to Control the Disease

1. Handle every lobster. Remove culls that are weak or have broken shells. Use a diver to remove weak and dead lobsters from pounds on a regular basis. Once a lobster is infected, the bacterium will grow in the lobster's blood and tissues, eventually killing the lobster. However, the disease will not spread by a healthy lobster eating an infected one. The infective bacteria are killed by lobster stomach acid.

2. Monitor your lobsters for disease by taking blood samples and culturing them to deter-

mine the relative incidence of the disease before it is apparent in weak or dying lobsters. It may or may not be practical to do this yourself. This service is available for a fee from an independent business. Samples may be done repeatedly at the owner's discretion or as medication is administered. This sampling procedure does not harm the lobster in any way.

3. Terramycin in pelleted form may be given to lobsters to control the spread of the disease. This medication must be used carefully to avoid residue.

4. Vaccination is another method that can be used to control gaffkemia. This method offers the advantage of no residue. However, each lobster must be individually injected with the vaccine.

How to Identify Gaffkemia in Weak or Dead Lobsters

Equipment needed:

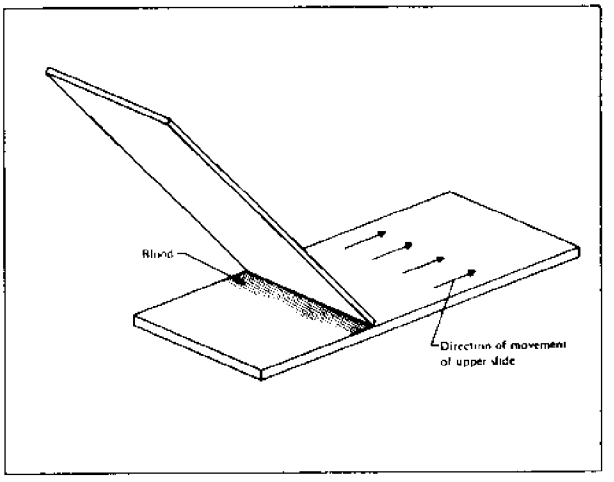
Microscope with oil immersion lens
Microscope immersion oil
Sharp object to obtain blood (syringe and needle if returning lobster to pound)
Glass microscope slides
Sedi-stain (bacterial stain)

Procedure:

1. Obtain a drop of blood from the lobster. A syringe and needle is least harmful to the lobster, and the sample is best taken from the claw joint. If a syringe and needle is not available, any sharp object will do.

2. Deposit the drop of blood (lobster blood is clear) in the center of a clean, dry slide.

3. Take a second slide and draw the edge across the blood to make a thin layer of fluid. This is called a "smear." Allow the slide to dry thoroughly.



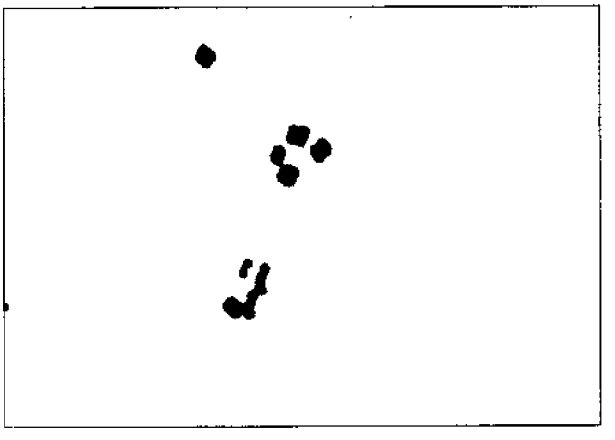
4. Put three drops of sedi-stain on the smear, wait 5 seconds, and rinse thoroughly with running fresh water. (If you wait too long before rinsing, the stain will be too dark; try again.) Let the slide dry.

5. Place slide in microscope with stain side up.

6. Place a drop of immersion oil on stained slide, then turn microscope lens so it rests in the oil. Focus the microscope.

If the lobster has gaffkemia, you will see the following:

Clumps of round, dark blue or black bacteria, often in groups of four.



If you can see the above in the blood smear, this lobster has red tail.

Using Medicated Feed to Treat Gaffkemia

In 1967, Stewart and Cornick established *in vitro* sensitivities of *Aerococcus viridans*, the bacteria causing red tail, to various antibiotics. Stewart and Arie (1974) administered several of these antibiotics, including oxytetracycline, by injection. These antibiotics proved effective against *A. viridans* but also appeared to be toxic to lobsters.

Experiments conducted by the University of Maine showed that lobsters eating a diet fortified with Terramycin could survive a direct gaffkemia infection. Also, during early stages of infection, if a lobster has the strength to eat the diet, its life will be prolonged or it may be cleared of the disease.

Recommended Procedure and General Guidelines for Terramycin Use in Tidal Lobster Pounds

Fall Pounding for the Winter Market

1. Do not feed lobsters any other feed on the days medication is being given. Be sure there is no uneaten feed left over before the medication is fed.

2. As a gaffkemia control, or what is called a preventative maintenance diet, feed 3 to 6 pounds of medicated pellets daily per thousand pounds of lobsters for 5 to 6 consecutive days. For best efficiency, feed as late in the day as possible because lobsters, being nocturnal, tend to feed best at night.

3. Medicated pellets should be fed when the first 5,000 to 10,000 pounds of lobsters have accumulated, or no longer than 10 days after the first lobsters were caught. Repeat this medication procedure when the next lobsters are about 10 days from the time they are caught, or after a large shipment of 10,000 pounds or more are purchased. If water temperatures are high, it may be desirable to feed when fewer lobsters are present. Feed greater amounts when the lobster density is low to assure that the lobsters will find the feed.

4. As the water temperature lowers in the fall, taper off on the amount of feed per thousand pounds of lobsters. The last feeding in November should be only 3 or 4 pounds per thousand.

5. Be aware that your lobsters may be more hungry than normal for a day or two after periods of feeding medication, similar to other animals which are fed Terramycin.

6. To medicate efficiently in the fall pounding period, there should be no less than 3 or more than 4 feeding periods of 5 to 6 days each if you begin storing lobsters around the first week of September and finish stocking in late November.

7. When there is an obvious severe infection, medication should not be used. These lobsters should be marketed.

Spring Pounding

Old shell lobsters in May and June usually eat about half the amount of feed daily as soft shells. Four (4) pounds per thousand pounds of lobsters for one 5- to 6-day period should be enough because of the short pounding period. Be sure to medicate the lobsters early enough so as to allow a 30-day period of time before you plan to market the lobsters.

Summer Pounding Soft Shells to Harden for Late Summer Market

Feed lobsters at least 6 pounds of medicated feed per thousand pounds of lobsters for 5 to 6 days and be sure to allow the 30 days before marketing them.

These are general guidelines for most lobster pound operations. If your operation varies from the norm, or if you suspect a disease problem with your lobsters, consult your feed supplier or contact the Animal, Veterinary, and Aquatic Sciences Department at the University of Maine at Orono.

WARNING:
Be Careful of Residues
Terramycin from medicated feed can be found in lobster meat after feeding. Lobsters should not be sold or meat from dead lobsters be salvaged for at least 30 days after a Terramycin feeding has ended. November should be the last month of feeding for winter storage as residue leaves more slowly in cold water.

The method of feeding medicated feed to lobsters as described on page 4 is approved by the FDA (Food and Drug Administration) in the U.S. and Department of Health and Welfare in Canada. ***Any modification of this method could cause residue problems.***

How to Feed Lobsters in Cars

First, some area of solid bottom will be needed in the car to retain the feed. Lobsters can be fed as follows: lobsters from the first day's catch will be placed in pen A and fed; the second day's catch in pen B; third day's in C; fourth day's in D.

When pen A has been fed for 4 days, those lobsters will be sent to the lower decks and the fifth day's catch placed in pen A, and the cycle continues so that each lobster gets 4 days on medication. If the car has more than four pens, a 5 to 6 day feeding cycle is more desirable.

As water temperature drops to the mid-forties Fahrenheit or below, less medication will probably be effective.

A	B
C	D

What the Medication Will Do

Those lobsters that have the disease in the early stages and eat the medication will clear themselves of the disease. Lobsters that are exposed to the disease and consume the medication will not develop the disease. However, any lobster that has gaffkemia and is at a stage where it is too weak to consume the feed will still die.

Preventing Antibiotic Residues in Lobsters

January 1986 marked approval of Terramycin (oxytetracycline) for use in lobsters. This compound must be used carefully to avoid antibiotic residue in lobsters going to market.

Animal food products are routinely analyzed by the Food Safety and Inspection Service (FSIS) in the U.S. for many different compounds including drugs, industrial contaminants, and pesticides. The experience of the animal agricultural industries has demonstrated that prevention is the most effective way to deal with residues.

Use Medicated Feed Wisely!

The first safeguard against drug residue is to use medicated feed conservatively, monitoring the level of disease in the pound or car.

Follow Feeding Instructions

Feed only the recommended level of Terramycin for the periods specified. Prolonged feeding periods or feeding greater quantities or higher concentrations of the antibiotic will increase the time it takes to clear the drug from the lobster.

Abide by the Withdrawl Time

The U.S. Food and Drug Administration has set a withdrawal period of 30 days minimum for medicated lobsters to go to market. A recommendation for farm animals is to allow extra time for drug withdrawal. The same should be fol-

lowed for lobsters. If lobsters are to be sold at Christmas, mid-November should be the target date to stop feeding medication.

Be Sure to Use Residue-Free Feeds During the Withdrawal Period

Lobster should consume only residue-free feed during the withdrawal period. Be sure your feed is adequately labelled so no mix-up occurs.

Summary of Residue Prevention Program

1. Use medicated feeds wisely
2. Follow feeding instructions
3. Abide by withdrawal times
4. Use residue-free feeds during withdrawal period.

A Rapid Method to Determine Antibiotic (Oxytetracycline) Levels in Lobster

Before lobsters can be marketed, their tissues must be free of all antibiotic residues. The hemolymph is the last tissue in the lobster to become free of antibiotic residue. Delvotest P—a commercially available product for detecting antibiotic residues in milk samples—is a simple, sensitive test for determining antibiotic residues in lobster hemolymph. This is important for lobsters that go to market and for dealers who want to know if their lobsters have consumed a medicated feed.

How to Perform the Delvotest P

Follow the directions provided with the Delvotest P kit for testing milk. The test involves taking a blood sample with a syringe and needle and incubating the sample. A color chart is provided to determine the presence or level of residue.

This section was prepared by Robert C. Bayer and Kathleen Anderson, Department of Animal, Veterinary and Aquatic Sciences, University of Maine, Orono, and Herbert Hodgkins, Lobster Products, Inc., Hancock, Me.

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Ciliated Protozoan 2

Until recently, the only major pathogenic organism affecting lobsters in storage was a bacterium that causes "red tail" or gaffkemia.

In spring of 1990, 1991, and 1992, pounds in Maine and Canada experienced high shrinkage when the lobsters were taken out. Lobsters from these pounds were examined at laboratories of the University of Maine in Orono or the Department of Marine Resources in Boothbay Harbor, Maine, and were found to have an infection of ciliated protozoans in their hemolymph or blood. This disease has been documented in crabs of various species and lobsters.

How to Identify a Ciliated Protozoan Infection

How Does the Protozoan Enter the Lobster?
The protozoan appears to penetrate the body of the lobster through its shell. A wound or break in the shell or soft tissue may be necessary for an infection to occur, although this is not certain. Protozoans multiply in the blood, devouring the lobster's blood cells. Mortalities can occur within a few weeks, apparently due to anemia and asphyxiation. At this point, it is difficult to know how much of a threat this disease poses to lobsters in the wild and in storage.

How to Recognize the Protozoan

1. The lobster's blood often looks milky since protozoans multiply and become concentrated during the terminal stages of the disease.

2. Place a drop of blood from the lobster on a slide and put a glass cover slip over it. Using low power, look at the slide with a microscope. If the lobster is infected, you will see oval-shaped cells moving around quickly in the field of view. Using higher magnification, you may actually see the cilia or hairs around the cells beating rapidly.

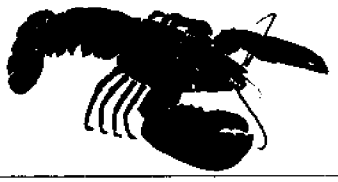
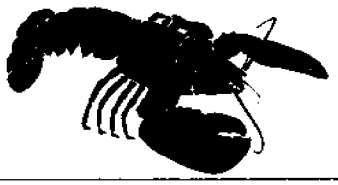
We Need Your Help

At this point, researchers are trying to determine the cause and potential cures for this disease. If you have observed ciliated protozoans in your lobsters, please let us know.

To report findings or for more information, contact:

The Lobster Institute
22 Coburn Hall
University of Maine
Orono, Maine 04469
(207) 581-1448

This section was prepared by Robert C. Bayer and Michael Loughlin, Department of Animal, Veterinary and Aquatic Sciences, University of Maine, Orono; and produced with support from the Lobster Institute and the Fisheries and Aquaculture Research Group of the Maine Agricultural Experiment Station at the University of Maine.

Shell Disease 3

Shell disease (also called rust disease, black spot, or brown spot) is a common syndrome in both marine and freshwater decapod crustaceans. The disease is an external infection caused by a variety of opportunistic microorganisms which attack the chitin component of the exoskeleton. Environmental stress and the presence of wounds are important factors in the onset of this disease.

Shell disease in the American lobster was first documented by Hess in 1937 in individuals removed from a tidal storage pound in Nova Scotia. Since that time, similar lobster holding facilities throughout Nova Scotia, New Brunswick, and Maine have dealt with recurring outbreaks of this disease. In addition to increased mortality, the disease produces a weak, aesthetically unappealing product which is unsuitable for sale. Lobster pound owners have experienced market losses up to 35% in some cases.

How to Detect and Control Shell Disease

Pathology

Typically, shell disease in lobster begins as a series of small pits in the shell, most noticeably on the dorsal carapace. As the disease progresses, the pits extend laterally through the shell and merge to form large, continuous lesions. The disease causes the shell to turn dark, giving the erosions a brownish appearance. In early or moderate infections, lesions are confined to the calcified layers of the exoskeleton. During severe infections, underlying epidermal tissue may die, and an overall loss of shell rigidity is apparent. The chitinous layer of gill filaments may also be involved.

There is not always a correlation between mortality and the severity of infection. Secondary infections probably account for a large proportion of deaths, especially when lesions develop into shell perforation. Mortality may result

when gill filaments are infected and the normal respiratory function is decreased. Individuals not greatly weakened by infection may rid themselves of the disease through molting.

Causative Agents

Numerous bacterial and fungal pathogens have been isolated from the lesions. Isolates are predominately Gram-negative bacteria of the genera *Vibrio*, *Pseudomonas*, and *Aeromonas*. These bacteria are common and widely distributed in the marine environment. No specific isolate appears to cause shell lesions. Most of the bacteria isolated from lesions are considered to be part of the normal flora of a healthy lobster shell.

Predisposing Factors

Invasion of the exoskeleton by opportunistic microbes appears to be facilitated by mechanical or chemical damage to the epicuticle, the outermost layer of shell. The epicuticle contains polyphenolic compounds which make it generally resistant to microbial attack. When this layer is broken, caused by improper handling and storage, the underlying chitinous shell layers may be infected.

Infections also appear to depend on the breakdown of the lobster's normal wound-healing response. Physiological stress from pollution, overcrowding, and poor water quality may produce such a failure.

Preventative Measures

Although there is no proven treatment for shell disease, it can be controlled in captive and cultured lobsters by avoiding wounds, practicing good husbandry, and maintaining hygienic conditions within the holding facilities. Wounding may be reduced through careful handling, regulating stocking density, and minimizing holding time. Hygiene can be improved by removing wastes such as uneaten feed and discarded shells. Lobsters displaying obvious signs of shell disease should also be removed. Water quality, especially oxygen levels, must be carefully monitored as well. Finally, lobsters should be given high quality feed to ensure adequate nutrition.

This section was prepared by Deanna Prince and Robert C. Bayer, Department of Animal, Veterinary and Aquatic Sciences, University of Maine, Orono, and edited by Joy Pye-MacSwain, Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, P.E.I.

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400