TECHNIQUES TO DETECT CHEMICALLY SCRUBBED, EGG-BEARING

LOBSTERS

A Guide for Law Enforcement Personnel

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BACKGROUND

The illegal removal of eggs from berried lobsters, referred to as "scrubbing," can have serious consequences for the industry. Removing eggs from lobsters and then harvesting them results in reduced numbers of female breeders and, ultimately, in decreased harvests. Traditional techniques to detect illegally altered and harvested lobsters have relied on specific biological and physiological charcteristics as indicators. Eggs in the gill chamber, limp abdomens, and/or swollen swimmerets are warning signs that lobsters may have been illegally altered. The swimmeret stain test, currently used by the Massachusetts Division of Marine Fisheries and coastal Environmental Protection Officers (EPOs), confirms that eggs have been removed mechanically (Syslo, 1986) which is most often accomplished by scrubbing with a brush, hosing with a high pressure water jet, or using compressed air.

Biological stains, particularly hematoxylin, are used to show the presence of the "cement" or "glue" (Yonge, 1937) which bonds the eggs to the setal hairs on the pleopods or *swimmerets*—small, fin-like appendages found under the lobster tail. Setal hairs are uniformly arranged in pairs that extend from a central shaft (seta), creating a characteristic feather-like pattern. The staining of setae on the swimmerets of a scrubbed lobster dramatically shows the remnants of the cement, which would only be present for the attachment of eggs. The cement, which stains purple, provides visible proof by which courts can judge guilt or innocence.

For the stain test, a swimmeret is removed from a suspect lobster, the hairs are closely examined for the presence of cement and/or egg casings, and the swimmeret is stained, fixed, and preserved as evidence. In the past, the combination of traditional biological techniques and the staining technique were successful in exposing and limiting the illegal harvest of berried females by giving New England marine enforcement officers the tools they needed to detect scrubbed lobsters (Morejon, 1975).

CHEMICAL SCRUBBING OF LOBSTERS

Evidence gathered over the past four years suggests that some fishermen are now dipping egg-bearing lobsters in chemical solutions to remove their eggs. According to recent reports from the field, a new and widely used (and extremely effective) method of egg removal involves scrubbing with a chlorine bleach dip. Berried females are immersed in a solution of chlorine bleach and seawater for a short amount of time. Following a soak, the lobster is shaken gently which removes all eggs, as well as residual cement and egg remnants from the hairs.

Since the cement residue is removed by this method, there is no stainable material and a negative swimmeret stain-test results. Because there are no obvious external signs of this chemical treatment, enforcement using former detection standards is impossible, and the lobsters are sold as non-berried lobsters. As a result, marine enforcement officers throughout the range of *Homarus americanus* are faced with the challenge of proving that berried females have had their eggs removed after being landed by a fisherman.

To help meet this challenge, two tests have recently been developed that law enforcement officials can use to determine if a lobster has been scrubbed with a chemical (mainly chlorine bleach) to remove its eggs. One is a field technique that detects residual chlorine on the lobster's pleopods and the other is a laboratory test that involves examining pleopod hairs under a compound microscope.

A FIELD TEST FOR RESIDUAL CHLORINE

Robert Bullis, researcher at the Laboratory for Marine Animal Health, University of Pennsylvania and at the Marine Biological Laboratory in Woods

Hole, Massachusetts, worked with Michael Syslo of the Massachusetts State Lobster Hatchery and Research Station at the Massachusetts Division of Marine Fisheries, to develop a field-based technique capable of detecting chemically dipped animals to compliment the swimmeret stain test currently used to determine scrubbed or brushed animals.

Based on the fact that chlorine penetrates the pleopods of chlorine-dipped animals (Bullis, et al., 1992) and that the rate of disappearance of chlorine in seawater can be measured for up to 10 days (Goldman, et al., 1979), the field test was designed to detect residual chlorine on the pleopods of suspect animals.

To test a suspect lobster:

1. Clip a swimmeret from the lobster.
2. Place the swimmeret in a transparent glass or plastic vial containing a solution of 20 milliliters of de-ionized water and 1 gram of potassium iodide. When a non-dipped swimmeret is placed in this solution, the liquid remains clear. However, if a swimmeret has been dipped in chlorine, the solution **instantaneously** changes to a bright yellow. The intensity of this color change is directly proportional to the time lapsed since the lobster has been dipped. Animals dipped more recently have the most intense color change. The intensity of this temperature-dependant color change falls off over time.

Lobster fishing trips are generally from one to 10 days in duration, with lobsters usually held in running seawater systems during transport to shore. This field test is able to detect residual chlorine under these conditions. The test is also fast, simple to use, easy to interpret with the naked eye, and cost-effective. Sample vials can be prepared ahead of time and stored in quantity at a cost of less than $.10 per vial. If necessary, interpretations can also be documented with a laboratory spectrophotometer (at 350 nanometers) that can measure and record this color change for use as additional evidence.

USING A MICROSCOPE TO DETECT CHEMICALLY SCRUBBED LOBSTERS

Another test, developed by Robert Bayer and Deanna Prince, University of Maine; Edward Cogger, California State Polytechnic University; and Roy Morejon, National Marine Fisheries Service, uses a compound microscope to determine if a lobster has been exposed to bleach. For this test, you will need a compound microscope, microscope slides, cover slips, and small jars of formalin solution.

To test a suspect lobster :

1. Take a small pair of scissors and remove a pleopod.
2. Place a drop of seawater on a microscope slide.
3. Put the pleopod on the water drop.
4. Cover the pleopod with a glass cover slip.
5. Examine at 50X-200X magnification.
6. If you wish to save the pleopod as reference or as evidence, place it in formalin solution.

When pleopods are examined under a microscope, there are distinct, observable differences in the structure of setal hairs on lobsters treated with bleach compared to those on lobsters that are untreated. The setae found on the pleopods of all untreated lobsters show a characteristic feather-like pattern with pairs of fine, uniformly arranged hairs extending from opposite sides of a central shaft (Fig. 1). Pleopod setae from lobsters dipped in bleach deviate from the typical feather pattern. These setae

Fig. 1 Untreated setae

display highly disorganized, bent, and even missing setal hairs (Fig. 2). Degeneration is more apparent at 48 hours after dipping in the bleach solution than after five hours. The observed differences are also easily detected in the formalin-preserved specimens.

Scanning electron microscopy (SEM), although not practical in the field, further enhances the feather-like appearance of the untreated lobster setae and the disorganized structure of the bleached setae. The setal hairs from untreated lobsters appear to be relatively straight, 1 micron strands. It is readily appar-

Fig. 2 Treated setae

ent from the SEM micrograph that the setal hairs from bleach-treated lobsters either appear twisted or bent, or they are entirely missing.

Researchers believe that it is probably not feasible to scrub lobsters on boats for longer than 2 minutes. In studies where lobsters were immersed for 2 minutes in bleach, the setae were damaged, although there was less damage as the bleach concentration decreased. At 5 percent bleach concentration, it took about 5 minutes to release the eggs and the damage was minimal but observable. When lobsters were immersed in a 20 percent bleach concentration, eggs were released in about 2 minutes, and damage to the setae was very apparent. The setae continued to exhibit structural damage for as long as 14 days, and the investigators believe they would continue to do so until the next molt was completed.

The observed differences in pleopod setae may not be specific to chlorine bleach exposure, but are distinct, easily recognizable indicators that the lobster has been exposed to some chemical irritant. The relative simplicity of this detection method makes it highly desirable for the purposes of enforcement.

CONCLUSION

With the development of these two relatively simple techniques to determine if lobsters have been exposed to chlorine bleach, it is hoped that the short-sighted practice of chemically scrubbing lobsters will stop. These methods, combined with those that detect mechanical scrubbing, give law enforcement personnel the additional tools they need to prosecute offenders, and thereby help reduce or eliminate the practice of illegally removing eggs from lobsters.

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