Further Experiments In Holding of Fresh Shrimp In Refrigerated Sea Water and Ice[1]

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At the 1952 meeting of the Gulf and Caribbean Fisheries Institute, the Marine Laboratory of the University of Miami presented results of experiments in the use of refrigerated sea water for holding fresh shrimp aboard fishing vessels (Higman & Idyll, 1953). It was reported that shrimp held in sea water chilled to 29°-32°F. were superior to shrimp held in crushed ice, in terms of flavor and appearance. Melanosis, or black spotting, was eliminated. A weakness of the method was the development of undesirable odors in the sea water-held shrimp.

Since that time further experiments have been conducted with the sea water method, principally to combat the odor problem. In addition, tests were run with ice-held shrimp in order to develop methods of eliminating the serious problem of black spotting.

In the sea water experiments several methods were tried in an attempt to eliminate odor. No improvement in quality resulted from changing various volumes of the refrigerated sea water. Further, the odor was not improved by the addition of any of the following: sodium hypochlorite, calcium hypochlorite, sodium bisulfite, Fram Kem, (a trade name for a mixture of fumaric acid and sodium benzoate), and Movidyne, (a trade name for a colloidal suspension of silver).

However, after these negative results, progress has been made in the control of odor by using the antibiotic, aureomycin hydrochloride.

Experiments were conducted in which one, five, eight, 10 and 20 p.p.m. of aureomycin hydrochloride were added to the refrigerated sea water in which freshly caught shrimp were being held. In each experiment pink shrimp (*Penaeus duorarum*) from the Tortugas grounds were used. At intervals tests were conducted comparing aureomycin-treated shrimp with shrimp held in untreated refrigerated sea water. The test panel rated the shrimp as to taste, odor and toughness. A five-point scale was used in rating the shrimp. The maximum rating was 5.0, and descending scores indicated shrimp of lower quality. For the purpose of these tests an arbitrary score of 3.5 was established for "good" shrimp. Lower scores were considered to indicate unacceptable shrimp.

In these experiments the taste and toughness scores for aureomycin-treated shrimp were similar to, but generally slightly higher than, the scores for untreated shrimp. These differences, however, were never great enough to be statistically significant.

Concentrations of aureomycin below five p.p.m. were ineffective in eliminating the undesirable odor.

At 10 and 20 p.p.m the antibiotic inhibited the odor, but caused a slight yellowish coloration on the shrimp muscle. This color was accentuated when the shrimp were boiled.

Three separate experiments at concentrations of five p.p.m. of aureomycin hydrochloride and two experiments at eight p.p.m. have been

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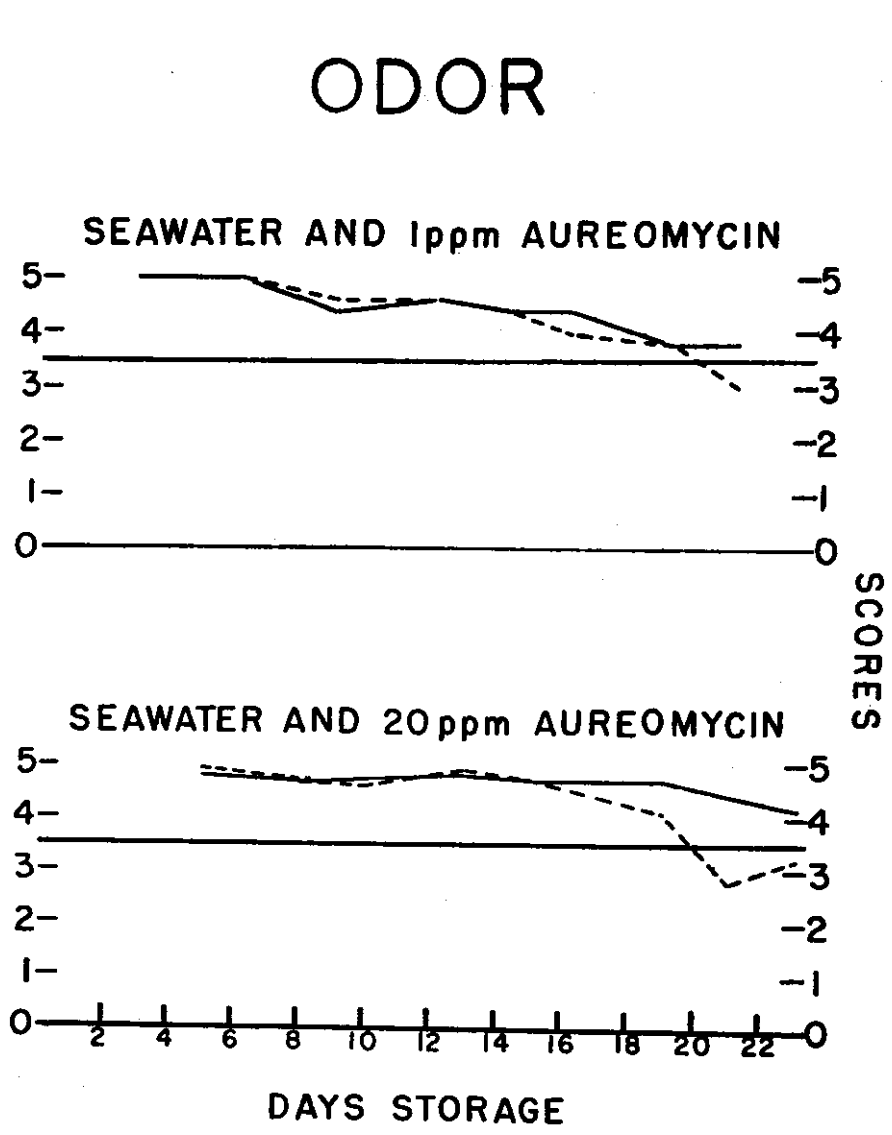

Fig. 1.

conducted. The results show that five p.p.m. concentration is the smallest concentration of antibiotic which inhibited odor without causing slight coloration (Figures 1 to 4).

The odor of the sea water in which shrimp were held was checked during the experiment. Undesirable odors were detected in the water two to three days before the test panel rated the odor of the shrimp objectionable.

No commercial use of these results is possible at present because of the prohibition by the Food and Drug Administration against the use of antibiotics in food. This ruling may be altered in the future.

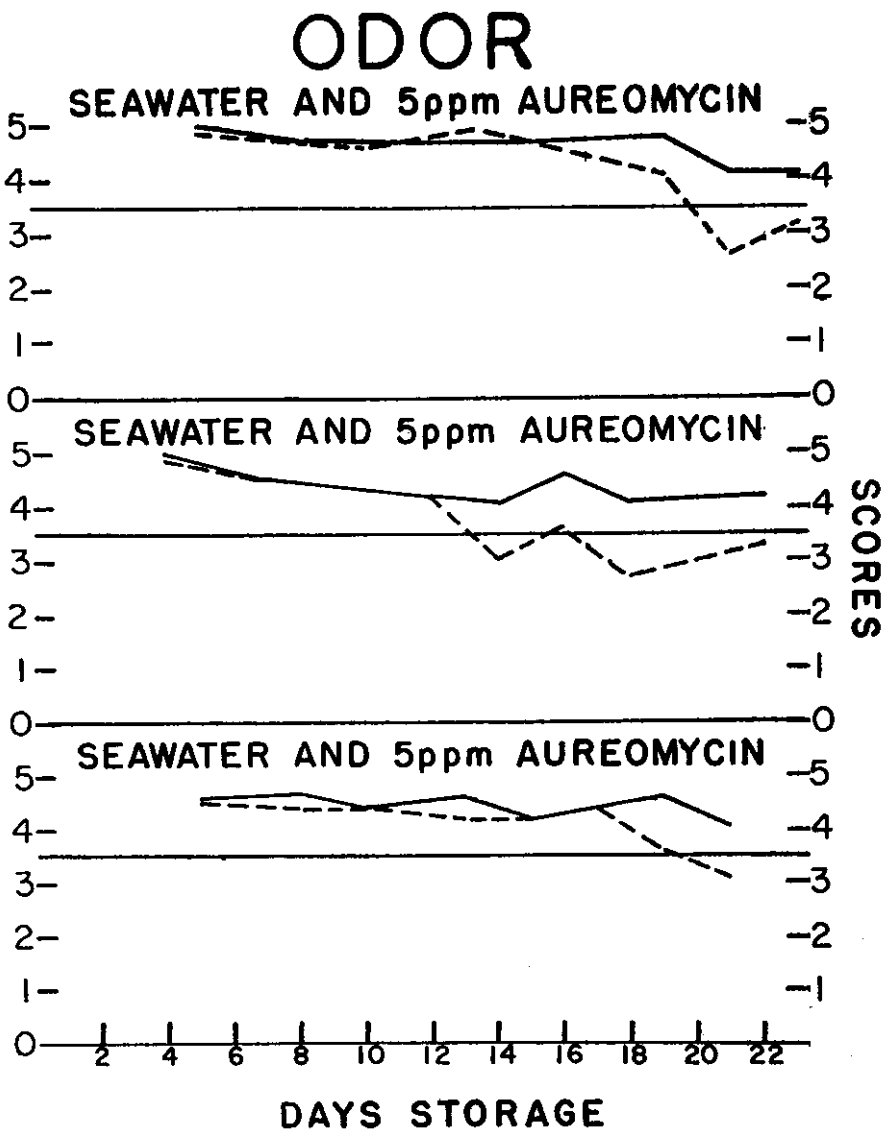

Fig. 2.

A second series of experiments has been designed to test improved methods of carrying shrimp in crushed ice.

The possible effect on quality of different sizes of ice particles was first tested. Shrimp taken from vessels fishing the Tortugas grounds were held at the Marine Laboratory in ice of three sizes. These were "snow" ice, such as is commonly used at present aboard the boats, "rickey" ice, in which the sizes of particles are larger than snow ice, and "flake" ice. No measurable differences in quality were detected in shrimp held in these three types of ice.

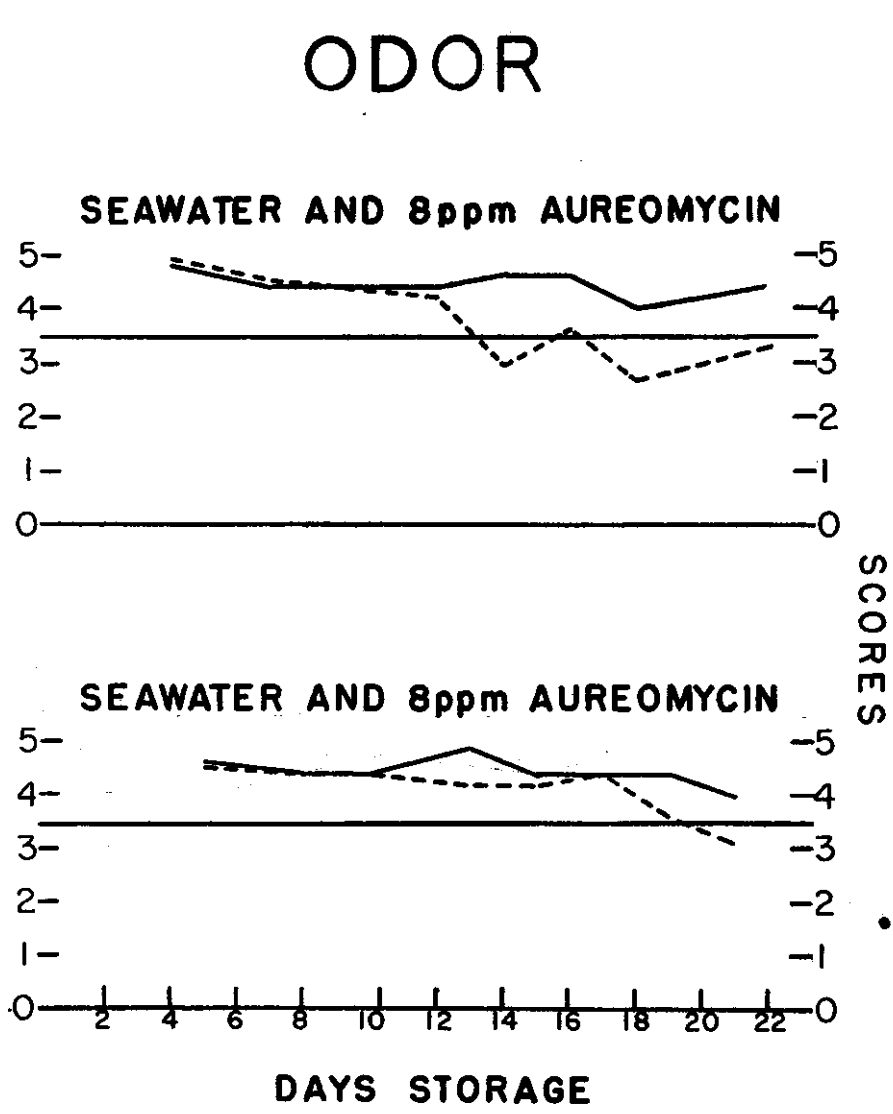

Fig. 3.

Tests were also conducted in attempts to reduce melanosis, or black spotting, of shrimp held in ice. Ascorbic acid and sodium bisulfite were tested. The ascorbic acid was ineffective, but promising results were obtained with sodium bisulfite in concentrations of one, two and one-half and five per cent. (See Figures 5 to 7.) A measurable reduction in the black spotting resulted in all cases but the best results were obtained with the two and one-half per cent solution. After the shrimp were headed and washed in the usual way aboard the fishing boat, they were dipped for about one minute in

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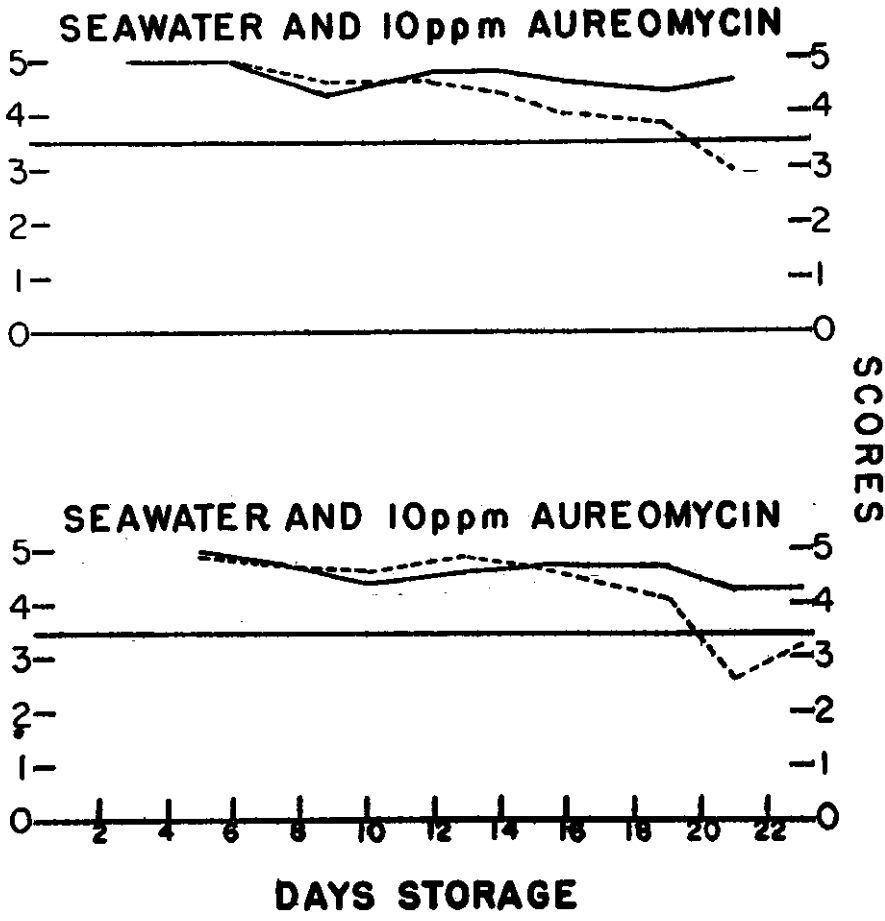

Fig. 4.

the sodium bisulfite solution. The shrimp were iced in the conventional manner. The experiments were then continued at the Laboratory, the shrimp being held in insulated ice bunkers. After seven to eight days they were dipped a second time in two and one-half per cent bisulfite solution. Shrimp dipped only once were not as good as those dipped twice. In commercial practice the second dip would probably be done at the dock, the wash water in the tanks being a solution of sodium bisulfite rather than plain water.

Organoleptic tests comparing treated and untreated samples were made in

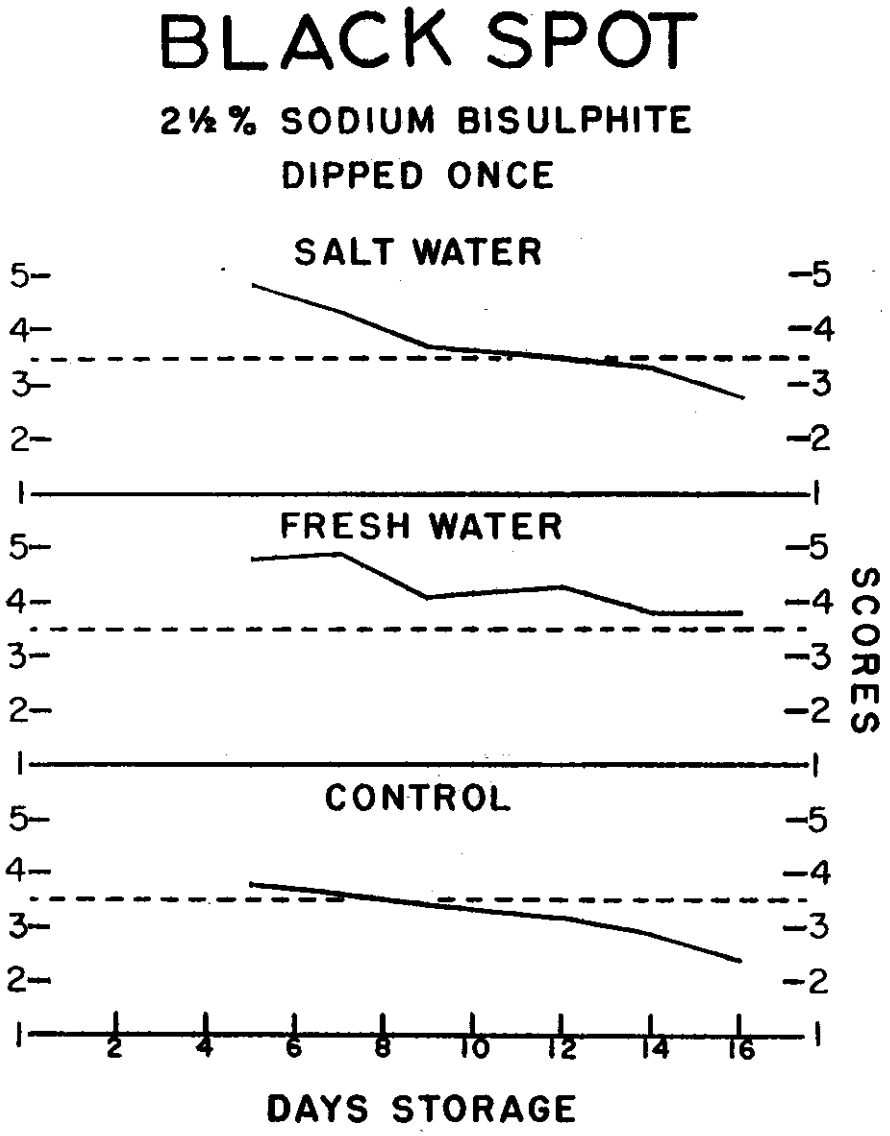

Fig. 5.

the manner described for sea water-held shrimp. The test panel rated the shrimp for taste, odor, toughness and development of "black spot."

Tests of untreated and bisulfite dipped shrimp show that there are no significant differences in taste and toughness among these samples. There is some evidence of better odor among bisulfite-treated shrimp.

Again, this chemical has not yet been approved for use by the Food and Drug Administration.

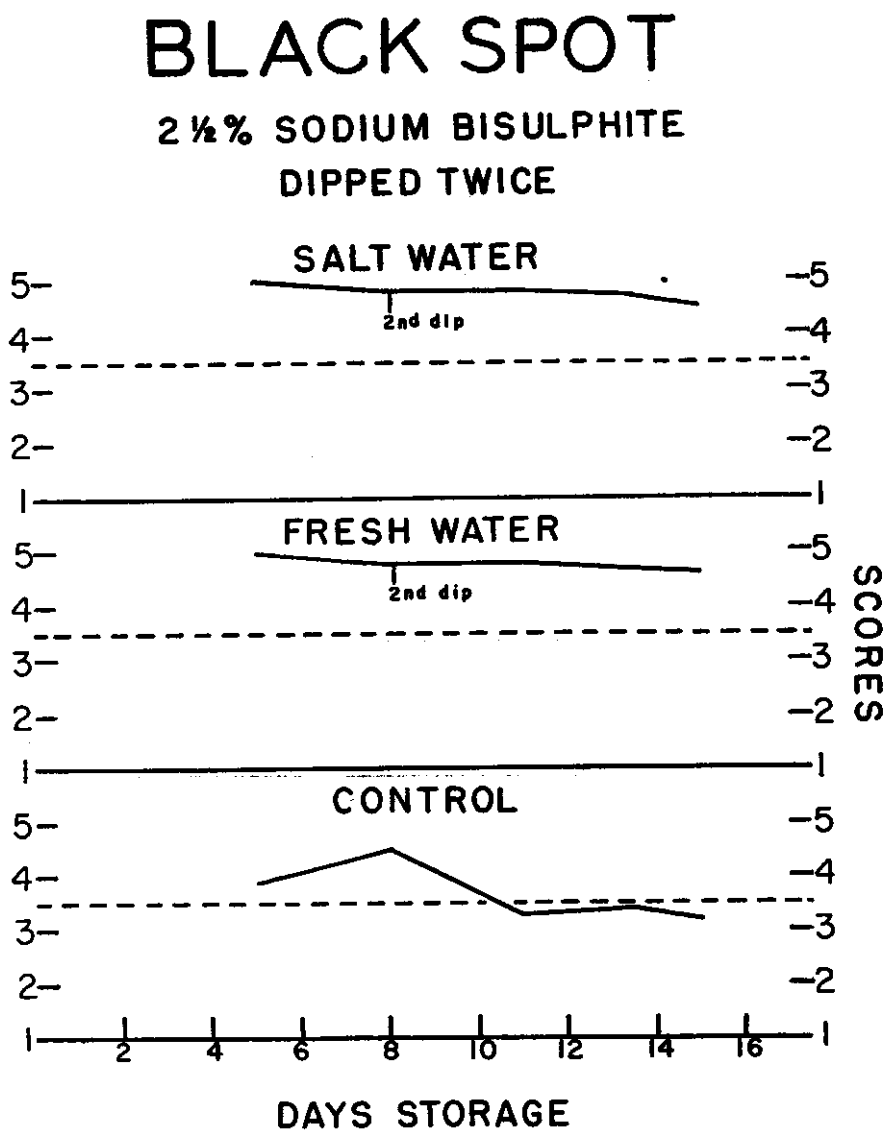

Fig. 6.

In summary, the following results are reported.

1. Repeated tests have confirmed that shrimp held in refrigerated sea water are as good as or superior in quality, with the exception of odor, to shrimp held in crushed ice.
2. Concentrations of five to 10 p.p.m. aureomycin hydrochloride eliminated the undesirable odors of shrimp held in refrigerated sea water.
3. No measurable differences in quality could be detected among shrimp held in three sizes of ice particles.

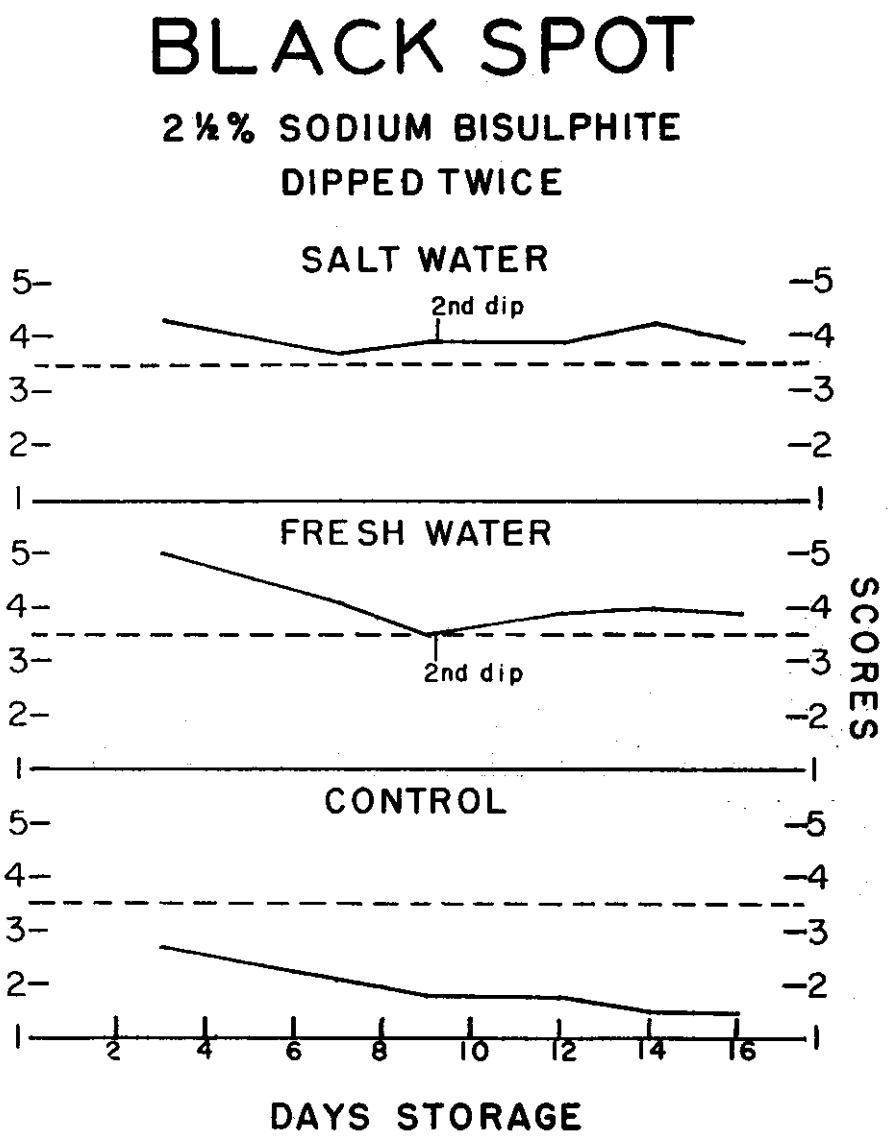

Fig. 7.

4. Shrimp dipped twice in two and one-half per cent concentrations of sodium bisulfite showed marked reduction in the amount of melanosis, or black spot, after being held in ice.

REFERENCE

HIGMAN, JAMES B. and C. P. IDYLL, 1953. *Holding Shrimp in Refrigerated Seawater.* Proc. Gulf & Caribbean Fisheries Institute, 5th Annual session, University of Miami, Marine Lab. pp. 41-53.