

deterioración bacteriológica y para extender la duración de almacenaje de pescado y otros productos alimenticios. La tendencia de ciertas soluciones de antibióticos de migrar al centro durante el congelamiento, se ha vencido con el uso de muy pequeñas cantidades de ciertos coloides protectores en combinación con iones metálicos.

El efecto del pH, tipo de coloides protectores, así como los tipos de iones metálicos son todos interdependientes y han sido estudiados concienzudamente tanto en el laboratorio como en plantas comerciales de hielo. El método se describe en detalle y también se explican métodos para análisis.

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## DISCUSSION

### Technology and Exploratory Fishing Session

Discussion Leader: JOHN ROBAS

Discussion Panel: WILBUR H. MILLER, GEORGE STEELE,  
WAYNE M. WALLER

### Further Experiments On the Control of Melanosis Or Black Spot On Shrimp

M. E. BAILEY AND E. A. FIEGER

- Q. Robas: Have there been any taste panel tests made on sulphite treated shrimp?
- A. Bailey: Yes. We found that in the shrimp treated with 100 parts per million sulphite there was no perceptible flavor that could be attributed to the sulphite. In slightly higher concentrated ices a few individuals acutely susceptible to the sulphite taste did actually pick it up, but there is, in my opinion, no appreciable change in flavor attributable to the sulphite.
- Q. Miller: I am interested in the effect of the pH of your solution on the action of the sulphite and the ascorbic acid in controlling melanosis.
- A. Bailey: The pH is very important in melanin formation. The farther the pH is from the optimal for activity of the enzyme the less is the melanosis development.
- Q. Miller: The stability of ascorbic acid is somewhat dependent on the pH also, and I wonder if you used sodium ascorbate, would it be more effective than the sodium bisulphite? I notice that you used 8% ascorbic acid and 92% citric acid.
- A. Bailey: The primary reason that we used the 8-92 mixture was to cut down the expense. Actually, the ascorbic acid, full strength, does a wonderful job in preventing melanosis, but at the present time it is much too expensive to be

considered for commercial use. True, the citric acid also acts to decrease the pH, and this in itself decreases melanosis somewhat.

- Q. Butler: In connection with the organoleptic tests did you at the same time run any storage tests? I am interested in the effect of sulphite concentrations after a six months storage.
- A. Bailey: No. They were checked only over a period of 16 days.
- Butler (Comment): We have found in our work with fish that samples sometimes do not at first show flavor changes, but on storage do develop undesirable flavors.
- Q. Strasburger: Did you make any bacteriological examinations?
- A. Bailey: Yes, we made bacteriological examinations along with a series of eight chemical tests for quality. We found that the sulphite ice-stored shrimp were a better product than those in the commercial ice.
- Q. Strasburger: What was the change in the bacterial flora on the sulphite shrimp as against those stored in regular ice?
- A. Bailey: All tests mentioned were total plate counts. There was no appreciable difference in the bacteriological counts until about the 14th day, but after this storage period there was an appreciable difference in the number of bacteria in the two samples. Concerning the shrimp in ordinary ice, there was a tremendous increase in the number of bacteria after about 14 days, and although the sulphite treated shrimp wasn't completely devoid of bacteria, there were considerably fewer bacteria in the samples that had been treated with the bisulphite.
- Q. Strasburger: Would you attribute that to the differential in pH?
- A. Bailey: That is a possibility, of course, but we haven't made a thorough study as to the actual mechanisms.
- Q. Anderson: Have you discussed the results of your experiments with the Food and Drug Administration? If so, what are their views as to the level of the sulphite solutions which might be used?
- A. Fieger: The New Orleans Laboratory of Food and Drug said that it would have to be shown that there was no bisulphite in the cooked product. This is unofficial and the ruling would have to come from Washington.
- Q. Szabo: How much would this sulphite treatment cost per pound of shrimp?
- A. Bailey: A 1000 ppm. sulphite ice would increase the cost of a ton of ice by about 50 cents. With a cruder sulphite we would have to increase the concentration but this would also decrease the cost considerably, so I wouldn't doubt that you get the cost to about 30 cents extra per ton of ice.

## Maintenance of Quality of Seafood Products During Transportation

CHARLES B. BOWLING

- Q. Robas: Is there any work being carried on now by American railroads which compares with the refrigerated freezer cars which the Canadian National Railway is experimenting with?
- A. Bowling: Yes, there are. General Motors has an experimental railway car in Florida. It cost them approximately \$30,000 to equip, and, of course, that is too expensive to operate commercially at a profit. We may see some such car in service on perishable freight in the near future.
- Q. Steele: Did I understand you right this morning when you said that you had been able to carry out tests on refrigerated transport of various farm crops, but you had been unable to get those same tests run on fishery products?
- A. Bowling: The Bureau of Plant Industry of the Department of Agriculture has for years undertaken an extensive amount of experimental work with agricultural products, but, of course, they have not entered the field of fishery products. I have recommended that similar tests could be run on fishery products by some other government agency, preferably the Department of Interior. I am certain that the Department of Agriculture would be glad to cooperate with them.
- Q. Steele: Hasn't it been ruled that fish and shell fish are under the jurisdiction of the Department of Agriculture in this particular field of endeavor?
- A. Bowling: Only insofar as transportation rates and service are concerned, but not concerning experimental work.
- Q. Xavier: We have a number of officials here from the Fish and Wildlife Service and I think they could tell us if cooperative research would be possible.
- A. Anderson: The last time we discussed the possibility of joint work with the Department of Agriculture was several years ago. We have never been able to make the proper arrangements, largely because fish, fruits and vegetables aren't produced in the same areas. We have run into technical difficulties in arranging cooperative tests. However, Agriculture has been perfectly willing to work with us and we're still willing to work with them if we can solve these problems.
- Q. Waller: Am I correct that the majority of shipments of seafood to the interior are less-than-car-loads?
- A. Bowling: Yes.
- Q. Waller: I understand the thing that really put Chicago, Omaha and Kansas City in the meat packing business was carload movements of meat to consuming areas. It is not practical to accomplish car load movement of frozen seafood products to the interior for distribution?

- A. Bowling: Undoubtedly the railroads would afford much lower rates for a heavy volume. If, instead of 3, 4, or 5,000 pounds, we could ship 30,000 pounds in a refrigerated car we would then get a much lower rate.
- Q. Waller: I don't understand why it wouldn't be practical for the sea food industry to move that much volume.
- A. Bowling: I assume because the distribution of seafood in such large quantities can only take place to the main cities. A good deal of the seafood of the country is now being moved by motor truck and the trend seems to be increasingly in that direction, which will account for the loss of carload shipping which was formerly a paramount part of the railway distribution of seafood.
- Q. Kahn: The last part of Mr. Bowling's paper refers to the sharing of risk. We have had cases in which the question of risk became an important one to the fish distribution. In one case a truck load of shrimp on their way from Port Isabel to New Orleans was stolen. Since it was not recovered until two days had passed, the shrimp were not in good shape. Who is responsible for the deterioration in quality of the seafood in this case? The shipper had double insurance: from his own insurance company and from the company of the common carrier. When it came to collecting the money, both insurance companies refused payment, because they said delivery was interrupted by causes for which they were not responsible. He also failed when he tried to collect from the common carrier since the carrier was unable to pay. The question is first, is there a legal basis that would require common carriers to carry insurance for such cases? Secondly, is there a list of common carriers who are responsible and who are able to pay for losses and will not try to escape legal obligations?
- A. Bowling: The Interstate Commerce Commission has a list or record of all certificated carriers. The assumption is that the shipper will on his own account investigate whether the carrier is responsible and if the carrier is covered by liability insurance. The Interstate Commerce Commission may require any such common carrier to file a surety bond for the purpose of compensating shippers or consignees for losses. This is contained in Section 215 of the ICC Act. The situation in question would seem to be one for the courts to adjudicate.

### **The Practical Application of Immersion Freezing of Shrimp On A Conventional Trawler**

W. L. MINGLEDORFF, JR.

- Q. Robas: What is the pressure at which your hydraulic agitator operates; is it a high pressure or a low pressure hydraulic system?

- A. Mingledorff: With the light load encountered in the agitator it operates around 600 pounds. It is a high pressure pump. It's the same pump used on hydraulically operated bulldozers to lift the blade, and will go up to 2000 pounds.
- Q. Robas: In your slide this morning, you showed the three baskets of shrimp being placed on top of the freezer cabinet to drain, prior to being placed in boxes and stored in the hold. What prevents those baskets from sliding around and falling back in the freezer when the vessel rolls?
- A. Mingledorff: The basket is fairly wide on the bottom and when you set it at an angle it does not tend to move.
- Q. Robas: The question that most concerns me about the operation of equipment aboard a vessel is the ability of the men to operate it. We find frequently that it is difficult to get the crew to keep a gasoline light plant operating. If vibrations cause leaks in the refrigeration systems, what can the crew do?
- A. Mingledorff: The refrigeration circuit is completely sealed and we don't want the crew to do anything. It would take a major leak to stop the system. The two systems are inter-connected so that the crew can switch from the refrigeration of the freezing tank and put that refrigeration unit on the holding room. The holding room is divided in sections so that if a leak develops even an unskilled crew can close the valve and isolate that section. As far as maintenance is concerned, if the crew has the intelligence to operate the main engine we feel they can operate the refrigeration. It is operated simply by cranking up the diesel and putting in the clutch. Once a week you check the oil in the diesel, and you still should not touch the refrigeration circuit.
- Q. Steele: I would like to ask Mr. Mingledorff a question that pertains not so much to his particular process of freezing shrimp as it does to the effect of freezing shrimp on subsequent quality, if they are to be thawed, for bread-ing purposes. We have had this problem presented by the Florida State Board of Health. Mr. Mingledorff, you said this morning that using your process of immersion freezing that you had thawed out the shrimp as many as five times with no noticeable difference in the quality of the shrimp. Is that right?
- A. Mingledorff: At the end of five thawings and freezings, there were no visual signs of deterioration. This is due to the extreme rapidity of the freezing.
- Q. Steele: One of the largest breaders that we have in Florida is of the opinion that it is impossible to thaw out any frozen product, including shrimp, without a resulting deterioration in that product.
- A. Mingledorff: I think that you'll find that the bulk of the bread-ing industry is using frozen products.

- Q. Steele: I believe you did some work on the brine system of holding shrimp. There was a time when that development was said to be one of the answers to holding shrimp aboard a trawler.
- A. Mingleдорff: At the time we started developing the refrigerated sea water we had no idea that the boat would ever want to hold fresh shrimp over 14 days. It became very obvious as soon as we started trying to sell it that the larger boat operating from Campeche, Mexico, was now going to stay out 30 days, and that the system was not applicable. It doesn't mean that it failed, because I still think that basically we had a good answer for the problem as it was presented to us at the time.
- Q. Steele: What is the cost of this system?
- A. Mingleдорff: Approximately \$12,000. The skipper of the *Prince Charming* estimates that just taking the saving of 5½ cents a pound that he would pay for freezing charges. This is plus the fact that all of the shrimp he sells are given the quality of "pearls".
- Q. Miller: I am interested in the skill of Mr. Mingleдорff's crew and in the point made that the quality of shrimp the consumer got would be not better than the quality when landed. I am particularly interested in how thoroughly the shrimp were washed on board the boat. I wonder, in the industry as a whole, how you are going to get crews that will head and wash shrimp thoroughly?
- A. Mingleдорff: I don't think there is any question as to the willingness of the crew to wash thoroughly. Most of them operate on shares and if their shrimp are graded as "pearls" they get more money; they'll wash shrimp thoroughly to get this.
- Q. Waller: Would you tell me the concentration of sugar in the solution and its function?
- A. Mingleдорff: I've been trying to keep the solution secret. That's about the only thing that I have to sell. It is approximately 50-50 sugar and salt. The sugar is very important from the standpoint of the glaze. The salt functions only to lower the freezing point. In order to freeze at 0° F., we have to have a high concentration of salt and sugar. I might say that the basic information came from the Fish and Wildlife Service reports on glucose and salt. This is not new, it's been in the industry for quite a while and was used on fish fillets for some time.
- Q. Anderson: Are shrimp prepared by your system available in consumer packages in Washington?
- A. Mingleдорff: No, most have gone to Food Fair stores in Miami, and have appeared on the counters in bulk.
- Q. Robas: Mr. Charles Ludwig is using a more conventional freezing method shelf freezer. I wonder if he would tell us something about his experience with this type of equipment and

indicate his opinion of how it would compare with the immersion freezer.

- A. Ludwig: My plate freezer is not too satisfactory. When the lines are frozen there is a lot of aggravation with it.
- Q. Robas: Do you consider that you have a good crew on the vessel?
- A. Ludwig: I have one of the best. They work hard and it still doesn't pay.
- Q. Ferguson: According to the Food and Drug regulations when you sell a product you have to list what it contains. Do you have to advertise that the shrimp have had salt and sugar added?
- A. Mingledorff: Apparently not in this case. Salt and sugar make up the freezing medium and are not necessarily added to the product.
- Q. Ferguson: Do you think that plate coils could be used in freezers in place of the customary copper tubing which is used in shelf freezers such as Mr. Ludwig has. Do you think that the use of those prefabricated coils would cut down the leakage?
- A. Mingledorff: We have had systems operating three years without a leak. We have had minor leaks on the *Prince Charming* but our system is so concentrated compared to a conventional installation that I anticipate that we will have fewer leaks.
- Q. McKee: I sold the first shrimp produced using this equipment. The first load went to Food Fair stores in Miami. They were thawed out and sold as fresh shrimp with very good success, and Food Fair wanted the next load from the *Prince Charming*. However, it was sent to a processor. At the plant they had most of them graded before the temperature had risen appreciably. The remainder of the large shrimp (16-20 count) were packed and refrozen headless. Now this company wants the next load coming in. These shrimp are the finest I've ever seen. I believe that if a boat owner figured only the savings on the ice, fuel and unloading charges, he could pay for the equipment, disregarding the premium he would get for the shrimp.
- Q. Strasburger: It has been our experience that in order to peel shrimp they must be held under ice for from 4 to 8 hours. I'm wondering what the experience of the processor was in regard to these shrimp?
- A. McKee: They did tell me it was a little more difficult to peel the shrimp because they were so fresh.

### **Fish Oils and Proteins: Their Contribution To the World's Feed Supply**

HOWARD O. STURGIS

- Q. Waller: I've been one of the severest critics of the menhaden industry over its apparent lack of interest in quality control.

Last week I heard a very encouraging report at the Virginia Fishermen's Association meeting of some work being done with aureomycin on the Gulf coast. Would you give this audience a quick run down on that project and its results?

A. Sturgis: We have been particularly interested in this work. We have been following very closely the work which the Fisheries Research Board of Canada and the Marine Laboratory of the University of Miami have been doing with aureomycin on edible fish and shrimp, because we felt that there might be some connection between that and the work that has been undertaken on menhaden. There has been developed a method of spraying the aureomycin in a fine vapor on the fish as they were dumped from the baskets, or as they were pumped on the menhaden vessels. It has been reported there was substantial improvement in the appearance of the fish and also a distinct improvement in the yield. Normally there is a loss of from 10 to as much as 25 or 30 per cent of yield. This can be an extremely important factor.

Q. Miller: I was certainly impressed this morning when I heard you tell about the nutritional advantages of fish meal for animal feed. Has there been work done to indicate any relationship between the nutritional value of fish meal or fish solubles with the quality of fish originally processed?

A. Sturgis: There has been a good deal of work done, more or less on a confidential basis. We know that the amino acid lysine, which is one of the most important amino acids and one in which the value is most easily destroyed, is lost as the fish decomposes. We know also that there are likely to be other losses, and we feel very strongly that anything that we can do to improve the raw materials will be of value to the feed industry.

Q. Fieger: What effort is being made to utilize trash fish caught in shrimping, and also the heads of shrimp?

A. Sturgis: There has been considerable effort to use that type of material. Many fish—not from shrimp boats, but other sources—that might have gone into reduction have been taken by the people who supply fish to the mink farmers. They are desperately short of proteins because the horse population of this country has virtually disappeared. The reduction plants can't pay as much as the mink farm suppliers. On top of that there are cat and dog food manufacturers, who can pay still more, so they are apparently getting the greatest amount of miscellaneous fish. Now, the question of shrimp trash and shrimp heads is somewhat different. The big shrimp boats head their shrimp at sea, and the shrimp heads don't come ashore at all. In other cases, where the smaller boats bring their catches ashore, they are apt to land very small quantities at any one particular spot. It



is a question of collecting those and sending them to a reduction plant, and frequently it isn't practical for them to make collections, although they do in some areas.

Q. Fieger: Is there a problem of rancidity when fish meal is added to feed?

A. Sturgis: Yes, especially with animal fats. There are enough natural anti-oxidants in most feeds when normal ingredients are used, but there are specific instances, especially in the north east area, where the fats and oils in the feed have such a high percentage of unsaturated fatty acids that they cause a problem. We do know today, however, that that can be completely overcome, as far as danger to chickens is concerned, by the addition of the proper anti-oxidant.

Q. Menzel: Back in the early 1940's the DuPont Company used the ribbed mussel to extract vitamin for poultry food. I've heard also of the use of star fish for fertilizer and for food. I'm wondering if there are any non-edible invertebrates used now?

A. Sturgis: I don't know of any.

Q. Osorio: I wonder if you are familiar with the tests that FAO is performing in a number of Latin American countries using fish meal for human consumption. The FAO Nutrition Division, supported by the Fisheries Division, drew attention to the little-explored possibilities of edible fish flours, containing up to 70 and 80 per cent of high quality protein as well as calcium and vitamin B<sub>12</sub>. UNICEF showed great interest in this possibility and it was decided to choose Chile as a suitable place for large scale tests of fish flour in order to gain experience with its acceptability in local dishes and other food preparations. With the cooperation of the Chilean Nutrition Department, several fish flours have now been tested, including samples from South Africa, United States and Germany. Bread made out of nine parts of white wheat flour and one part of fish flour has been used for the tests with very good results for some of the samples. Each three-ounce bread roll contains about 6.3 gms. fish flour. This flour represents 4.8 gms. protein or the amount in four and a half ounces of milk and 446 milligrams of calcium, which is the content of about two glasses of milk.

Further tests of fish flours are now being carried out in Ecuador, Mexico and Peru. In Mexico, for instance, fish flour is being tried with tortillas made out of maize. We expect that edible fish flour will mean more fish for human nutrition.

A. Sturgis: There has been a great deal of interest in the USA in this experiment and that's one more reason why the National Fisheries Institute has decided that it was time we got away from the name of "by-products".

## Recent Explorations for Yellowfin Tuna in the Gulf of Mexico

HARVEY R. BULLIS, JR.

- Q. Waller: It was certainly demonstrated to my satisfaction this morning that there probably is a tuna fishery in the Gulf. It also seems to me that with considerable ease you could take a substantial tonnage of sharks. Do you know of any interest at the present time in the utilization of sharks so that we have any promise of bringing to life another shark fishery?
- A. Bullis: There is one outlet for shark livers that is just starting in Pascagoula. I believe that it is the first shark liver processing company that has been in operation for the last five or six years. The operators seem to think that they can pay a good price for shark liver. This would be a valuable by-product to long-line fishing in the Gulf. However, the most common off-shore shark is this white fin shark, which seems to have liver oil of close to the lowest potency of all species. There is also a possibility of a market for shark fins, and for shark skins there is a very good market available. As far as the meat is concerned, special tests by fish producers along the Gulf coast have not been too favorable to date.
- Q. Robas: I wonder, Mr. Mowbray, if you would tell us whether or not there is the possibility of a tuna fishery along the island of Bermuda.
- A. Mowbray: I definitely think so. We've been working on it for quite a while, and next year, if all goes well, I hope to present a paper describing a long line tuna industry off Bermuda. I would like to ask Mr. Bullis how the selection of the locality of the sets was made.
- A. Bullis: We have been primarily trying to see in how wide an area we could catch yellow fin tuna. There was concentrated fishing in only one locality. Our emphasis next year will be more on trying to pinpoint localities. The last trip, which took place in the latter part of September and early October, was designed to give some picture of differential catch rates throughout the Gulf from east to west. We made eleven sets at one degree intervals, starting right off the continental shelf of Florida and heading over to Brownsville, Texas. Our catch rates show an increase as we approach the center of the Gulf and a very rapid falling off as we approach the Texas coast. The only oceanographic connection we can make with that observation is the fact that in the central Gulf there is one branch of the Gulf Stream that heads north.
- Q. Robas: Mr. Wiles, I'm curious about the possibility of long lining tuna around Barbados.
- A. Wiles: Nothing has been done to try long lining for big tuna in the Caribbean as far south as Barbados. It is on my program

for next year, but it will take three to four months more to get the gear prepared. Our bait will be flying fish. We can see the tuna and know they are there. A problem is that they are much bigger than those in the Gulf, ranging from 180 to 250 pounds.

- Q. Mather: The opinion often expressed by taxonomists and sport fishermen is that there are two species of yellowfin tuna, an Allison and a common yellowfin, the Allison being long finned and the common one being short finned. All of this has been based on rather flimsy evidence. Could you make a comment on this subject?
- A. Bullis: My personal opinion on the subject is that it is a single species.
- Q. Mather: The age of yellowfins in the Pacific has been estimated by length frequencies. Rivas and I found that length frequencies can be used to calculate age of bluefins in the Atlantic, and it would be interesting to check the age of the yellowfins you're taking with the age of the Pacific yellowfins, and also of the bluefins. The indication from the Pacific is that the yellowfin there grows much faster than the Atlantic bluefin although it reaches a smaller final size.
- A. Bullis: We've plotted the length frequencies for the Gulf yellowfin, but only over a period of May to mid-October. From the curves it appears that there is a colossal growth rate. It seems comparable to that of the Pacific yellowfin. The size classes range from 10 pound average to 50 or 60 pounds, which would indicate a growth of perhaps 40 to 60 pounds in one year.
- Q. Mather: This long line fishing not only indicates a great future in the Gulf but I think we can at least hope for good results in other tropical areas such as the Caribbean and the open Atlantic. We have found indications that there are yellowfins and other tuna-like fish in the Guiana current area, especially around the bulge of Brazil and even out into the Equatorial current system of the Atlantic. A tuna fishery should have several strings to its bow for it to be a success, with the fluctuations which occur in the abundance of fish in any particular area. What is the possibility of expanding your research in these areas, and do you think that possibly a West Indian tuna fishery could operate in the Gulf, the Caribbean, the Atlantic and possibly the nearby Pacific areas?
- A. Bullis: We've achieved these results with very few surface indications of the presence of yellowfins. We had no previous records to go on, and if we can make catches like these where they have never been seen previously, certainly we ought to be able to duplicate them in areas where yellowfin are repeatedly reported. Our cruise schedule for next year includes two cruises that will make transect from the

central Gulf down into the western Caribbean. Yellowfin tuna extend in a band completely around the world from the Gulf of Mexico to the Pacific coast of Central America, and commercial fishing linking up the areas you mention is actually opening now on a small scale.

### Exploitation of Deep Water Shrimp In the Gulf of Mexico

STEWART SPRINGER

- Q. Robas: How does the shrimp captain locate these deep beds? Working in 180 to 250 fathoms of water, it seems that it would be impractical to use a try net; he would be spending all of his time pulling the try net.
- A. Springer: He would merely trawl in the area. Apparently in the areas where these shrimp occur they are reasonably widespread, and time drags are probably in order. Of course, it would be necessary to have more elaborate equipment than usual, including a deep depth sounder, and perhaps loran would help him locate the spot. Actually the depth range is very precise, so it would be easy to get into a shrimp producing area if the area were known and if the boat had satisfactory equipment.
- Q. Higman: As a student I was in 1951 a Fishery Aide on the *Oregon*. You were catching some of the red shrimp off the Mississippi Delta. My job was recording bottom temperatures and other hydrographic data. Have you found any temperature correlation with the occurrence of these shrimp?
- A. Springer: I don't know whether there is any correlation. Our records on bottom temperatures at 200 to 300 fathoms are scarce.
- Q. Miller: I am interested in the fact that you indicated that the carbohydrate concentration might be different in 50 to 270 fathoms compared with shallower water, because of the obvious implications for differential bacteria life. Do these shrimp have different keeping qualities compared with ordinary shrimp?
- A. Springer: That is a problem that the industry would have. These shrimp are softer and I imagine they would be difficult to handle. They must be headed promptly or the juices from the head discolors them. Of course, they don't taste like the other shrimp and don't look like them so they are not necessarily competitive. We have frozen all our shrimp aboard the *Oregon* and we get a beautiful product. People who have seen them have indicated that there should be no problem in selling them. We don't know how they would keep under icing conditions.
- Q. Steele: Nothing excites a shrimper more than the possibility of finding new shrimp grounds. Mr. Springer, do you regard the red shrimp as a marine oddity or is there a good possibility of another fishery in the Gulf?

- A. Springer: I can't answer that very well, but I do think that there are in the Gulf very large untapped shrimp resources. These may be as large as the shallow water shrimp resources. For immediate interest, there were large boats idle last year which could have entered into some commercial exploitation of these deep water shrimp. Had they been equipped to fish these deep areas, I think they could have made successful trips. Of course, so far we don't know of more than two or three places where the shrimping would be good for this one shrimp, *Hymenopenaeus*. I think that there are more, but that is just a guess.
- Q. Steele: What is required in the way of equipment to adapt a vessel for this shrimping?
- A. Springer: A depth sounder that is capable of operating down to 300 fathoms. In addition, the winch should be capable of handling a minimum of 700 fathoms of wire. If half inch wire is used, I suspect that a bridle system would be desirable. This is not possible with most winches that have been used on shrimp boats because the drums aren't large enough to accommodate 700 fathoms of half inch wire.
- Q. Steele: Am I right that these red shrimp have been marketed commercially?
- A. Springer: No. We have turned some of them over to a shrimp company for examination. They report that the shrimp probably would not be suitable for canning. They would find a premium market solely as a frozen product, in all probability.

### **A Practical Method of Dispersing Aureomycin in Commercial Ice**

S. D. UPHAM AND F. E. STIRN, J. F. WEIDENHEIMER, F. M. CALLAHAN  
AND L. RITTER

- Q. Miller: Dr. Upham, you have indicated that the antibiotic was available after it had acidified. What is of particular concern is the availability of the antibiotic as the ice melts. Could you tell us about any experimental work you may have done on this?
- A. Upham: We have checked our spectrophotometer analysis against bacteriological assays. As far as we can see, we have the whole assay value from this ice. In fact, if you make the insoluble compound from calcium, aureomycin, and one of these gels in a very concentrated solution, you can even isolate and dry it, and it retains full activity.
- Q. Steele: I'm interested in the relationship of Dr. Fieger's sulphite and aureomycin. Do we need both of these or will one do the job? If we need two can use both of them at the same time?

- A. Upham: I'm not sure whether you can use aureomycin with sulphite or not. I don't know how you can keep the bisulphite from migrating in an ice block.
- A. Fieger: We haven't done any work in trying to prevent the migration of the sulphite during the freezing of ice, but we plan to start work on that immediately.
- Q. Robas: I would like to ask Frank Welles if he would tell us briefly of the experiments with the use of aureomycin on red snapper.
- A. Welles: We have run one test of the aureomycin ice on one of our vessels. We iced 75 pounds of fish in each of two boxes, one with regular ice and one with aureomycin ice. Each box was handled identically all the way through the trip. At the end of a five day period we took a fish from each box and froze them; at the end of 10 days we froze another fish and after 15 days we froze a third fish from each box. Unfortunately we weren't able to complete the test our our satisfaction because bad weather developed in the Gulf and our boat had to go into Galveston. In trucking the fish back to Pensacola, it wasn't handled as well as we wished, but the results that we had on the bacterial counts indicated clearly to me that aureomycin has definite possibilities, in fact fantastic possibilities in the preservation of fish. One of the things that I rely on, of course, is the opinion of the men of the vessel itself. The captain of this vessel, who is one of the best in the Gulf, told me that after four days in the ice he could see a definite difference in the appearance in the fish. We plan to run another test the first part of December, when we will ice down considerably more fish, and I think that at that time we will get some conclusive results.
- Q. Fieger: Dr. Upham, you reported that Tarr had obtained remarkable results with the aureomycin on fish. Did he use the aureomycin with the colloid and the calcium to freeze it into ice blocks?
- A. Upham: Yes.
- Q. Fieger: Do you have any explanation why the aureomycin is effective on fish and is not so effective on shrimp?
- A. Upham: I really don't know, unless it concerns differences in penetration.