

made. (East of the Mississippi Delta and southwest of Dry Tortugas in the Gulf of Mexico.) By next summer, when some repeat seasonal coverage has been made, a much better picture should be available. Also, it is very probable that within the next few months intensive commercial fishing will be carried out on these grounds, providing some early tangible data on commercial possibilities.

DISCUSSION

Exploratory Fishing and Technology Session

Discussion Leader: LAWRENCE W. STRASBURGER

Discussion Panel: FRED JUNE, LEO LEVINSON,
E. A. FIEGER, PHILLIP S. WOOD

A New Federal Fishing Laboratory on the Gulf

CHARLES BUTLER

- Q. Strasburger: How many people will you have at the Pascagoula Laboratory?
- A. Butler: The personnel will be designed around the program, but will have three people initially. A qualified director will work in the area to find out what are first priority projects. We will also have a chemist and a bacteriologist.
- Q. June: Considering the rapid deterioration of shrimp on boats, would it not be useful to investigate the possibility of some pre-processing of the product on the shrimping grounds; that is putting gear aboard the vessels which would make available to the market a better product?
- A. Butler: That is, in effect, what we were trying to do a number of years back with freezing at sea. We also tried with fin fishes to develop techniques for filleting and freezing the fillets in a package at sea. But there are two problems, the amount of manpower aboard the vessel, and the degree of skill involved. It is asking a lot of the fishermen, who know only how to fish, to do these other types of work. In the Gulf there is difficulty with refrigerated vessels because the personnel do not know how to handle refrigeration equipment. If you go to the next stage of asking them to do something with the product which involves shore processing knowledge, that is a big order for the small crew of a shrimp boat. With a larger vessel you have a still bigger investment, more people involved, and hence larger expenses. So we feel that by the application of good practices of handling and sanitation we can best get a product back to shore. On the basis of work that has been done on fin fishes, we think that this can be done. If it proves unprofitable or unfeasible, we then have to find another solution.

- Q. Miller: I am interested in getting a yardstick of good handling practices from the viewpoint of the antibiotics. Antibiotics are primarily bacteriostatic, rather than bacteriocidal so a low bacterial count is important. In Canada we have some rules to live by, and the rules imply very good handling practices in the industry itself. In this country are good handling practices, which you develop through research, going to be followed up by industry and are they going to be a yardstick that we can use in our new developments with the use of antibiotics in fish?
- A. Butler: We work in research and we are not an enforcement agency. We certainly will come up with recommended practices where we find that practices could be improved. There is a lot that could be done in improving fish quality with what we already know. It is a matter of education and constant re-education. Personnel and circumstances will change and you have to go right back and start the education over.

Progress in Technological Studies on Menhaden Products Under the Saltonstall-Kennedy Program

THEODORE M. MILLER

- Q. June: Have there been any studies to determine the bacterial load of the dried scrap as it comes from the dryer?
- A. Butler: We have made a study of the bacterial flora on the meal at various stages. It is practically sterile in the pile and the effect of bacteria during the curing stages is absolutely nil. Any changes which we observe must be due to oxidative changes in the oil, or some combination of the protein and the oil, rather than bacterial changes.
- Q. June: We know at certain times that there is a great loss in the raw product due to spoilage. Would it be practical to use refrigeration for cooling the fish at the time of capture?
- A. Sturgis: Results of work done along those lines are inconclusive, but they look promising. The costs of refrigerating the vessels are substantial. Also, we do not know yet exactly what the difference may be in the quality of the end products from fresh fish and spoiled fish. Of course, there is no doubt that there are substantial physical losses because of deterioration of fish, particularly in the Gulf area where temperatures and humidity are high.
- Q. Strasburger: You said you are trying to establish a quality index and you also said you are establishing quality control. Now without a quality index already established, how can you establish quality control?
- A. Sturgis: Initially, the program was designed to develop a quality index for fish meal. We recognized that this was going to be an extremely complex problem and we knew that the soy

bean industry had come against a solid wall despite the fact that they were working with a product far less complex than ours, a product that could be controlled from the point of sowing the seed, to manufacture. With us this is not possible, and we have large variables in our raw material. So, recently we have changed our attack and are doing some more basic work. This is to determine more exactly what components make up the fish meal and their availability to the animal eating them. Hence, our "quality control" refers to standards for the finished product, not control of methods of manufacture. We are interested in broadening the market for fish meal and finding other uses for it. To do this, we have to describe the product more carefully and control its uniformity.

Fellers:

This new approach is an important one, but I don't see where we are going unless we change the ideas of the feed purchasers and persuade them of the worthwhileness of paying more for improved feeds. You can't convince a fish meal producer that he should change his equipment when he can't get any more money for the new kind of meal. It is possible to produce a very good quality meal that may be used ultimately for human consumption, but I doubt that it will happen in this country.

Sturgis:
(Comment)

There is no question that it is extremely difficult to persuade a feed manufacturer that one meal is particularly different from another. On the other hand, feed manufacturers are becoming more and more conscious about quality. For certain purposes there is no question that some feeds without any fish meal can do the same kind of a job that can be done with fish meal. There must be a certainty of the amino acid content, both as to kind and quantity, and we have to establish ways of determining this on a standard basis.

Progress in Studies on Oxidative Deterioration in Fish and Fishery Products

HAROLD S. OLCOTT

- Q. Strasburger: How did you measure the tocopherol content of the oils you studied?
- A. Olcott: The method we used is a modification of a colorimetric method, the Emmeric-Engel method. It supposedly measures total tocopherol. There are now seven different tocopherols known to occur in nature; these have different biological activities and different antioxidant activities. We are interested in finding out what tocopherols occur in fish oil, and in determining whether their antioxidant activities can account for the stability of the fish oil.
- Q. Levinson: Is there any study being made of side reactions that follow

the use of antioxidants for control of discoloration or rancidity?

A. Olcott: The amount of antioxidant used is of the order of 1/10 to 1/100 of a per cent, or less, and therefore it is very unlikely that there would be any secondary reactions which would adversely affect the proteins, the texture or other characteristics. Their acceptability in food stuffs depends upon agreement that they are completely harmless at the levels to be used.

Q. Bullis: Your slides seemed to show that discoloration in tuna is a question of processing. In talking with people in the California tuna canning industry they maintained that the Japanese tuna that they are importing into the country, each had a very large notch immediately behind the second dorsal fin and they assume that it was made by the Japanese to check the quality of the meat, so that the shipment of green fish or bad fish would not be made. They maintained that the imported fish very seldom turned out to be green or discolored. Apparently some test can be made on raw frozen tuna to determine if they are going to cook out green or discolored. That would seem to be contrary to the work that you described this morning.

A. Olcott: Some of the green tuna that we have looked at have been supplied to us by a firm in San Francisco which uses nothing but Japanese imported tuna; so the Japanese imported tuna are sometimes green too. The Japanese have done a lot of work on attempting to identify in advance whether tuna would turn green and a paper has been prepared by Japanese workers who claim that a measurement of the myoglobin and hemoglobin pigments in the tuna will give a definite method of judging whether it will turn green. However, a Fish and Wildlife Service man from Hawaii tells me that one of the authors of this paper visited an Hawaiian tuna plant and tested fish for potential greenness. Guessing would have yielded better results. Hence this test is of doubtful significance at the moment. However, we are definitely not of the opinion that greenness is primarily due to processing.

Bullis: I have seen some figures on the percentage of green fish from the western Pacific Japanese tuna fishery and they have about 30 per cent of green fish. Other figures indicate that the fish imported to the Pacific coast run about 5 and 10 per cent, so that would seem to indicate that someone is doing some good guessing or the test must have some value.

A. Olcott: The larger the fish is, the more chance there is that it will be discolored. The imported tuna that we have seen have not been very large ones. That may or may not explain it.

Butler: It is only fair to state that most people don't really know what they mean by "green" tuna. There are two problems

actually; one is the true green tuna which has odor, texture and color differences from normal fish. The other is just a coloration which here in the Gulf means nothing in terms of true quality of fish. The Japanese are only working on the true green tuna and have been for a number of years. I agree with Dr. Olcott that they have so far not been very successful but they are still trying and so are we. Eventually we might come up with a simple test. If the test is complex it is just as worthless as the objective test that the Food and Drug uses, because you cannot use it in the field work. We hope that the type of work being done at the University of California will eventually give us the answer to the chemical problems and then we can work back from that to a procedure that can be used at the plant level or even aboard the vessel.

- Q. Strasburger: Your last slide seemed to infer that the discoloration in tuna might be reversible. Is that correct?
- A. Olcott: Yes.
- Q. Strasburger: Is there a possibility, then, since it was inferred that "greening" might be an oxidation process, that greening could be reversed also?
- A. Olcott: Yes.
- Q. Strasburger: Has it been tried?
- A. Olcott: It has been tried in the laboratory and it is possible to get a reversion to the pink color by the addition of a reducing agent, and by the heating which takes place in the process of canning.
- Q. Strasburger: I have noticed the presence of an off-odor attached to green tuna. Is that odor eliminated in the reverse process?
- A. Olcott: I don't know, but I would doubt it. While many odors in tuna are reduced or eliminated in the cooking, and pre-cooking, it is not reasonable to expect that the reducing agent would have an effect on the odor. It also could not be expected to take care of any texture problem,

Royal Red Shrimp - A New South Atlantic Resource

HARVEY BULLIS

- Q. Levinson: You mentioned the differences in texture and taste in comparing the red shrimp with those now in commercial use. Can you give us a little more information on this?
- A. Bullis: There is only preliminary information available. However, if red shrimp is cooked in the same manner as brown or pink shrimp, the meat gets soft. If the cooking time is shortened the shrimp maintains its quality and remains tender. Over-frying tends to harden the flesh, and a shorter frying time than that used on regular shrimp is required. When the new laboratory is complete in Pascagoula we can carry out more extensive tests.

- Q. Levinson: How about differences in plant handling?
- A. Bullis: The red shrimp seems to be a little softer when it is alive. Under these circumstances the normal procedure of filling a whole bin with crushed ice could mutilate the red shrimp tails more easily than regular shrimp.
- Q. Levinson: Is this softness similar to that found in pink shrimp which is called "soft shell"?
- A. Bullis: No, the meat is just softer. When fish are brought up from very deep water the meat is usually soft and mushy. Whether this is a problem of pressure or not, we don't know.
- Strasburger:
(Comment) Some time ago in a comparative cooking test we found a higher weight loss due to cooking in the red shrimp than in any of the other presently used species. We had about 15 to 18 per cent less cooked weight on the red shrimp than we did on the pink shrimp or brown shrimp. Another point is that the red shrimp will not peel well and loses its red pigment in peeling and canning.
- Q. Stein: Do you cook the shrimp prior to peeling or do you peel them raw?
- A. Strasburger: They are peeled raw.
- Stein:
(Comment) The shrimp pigment is situated in the layer termed the hypodermis just under the shell and I have noticed that heating in cooking causes the pigment to adhere more strongly to the muscle. It might aid in color retention if the royal red shrimp were pre-cooked prior to peeling.
- Strasburger: You are correct. However, we have found that pre-cooking makes peeling more costly and difficult. The present large volume of shrimp being handled and the hardness of the cooked tails do not allow clean peeling. The design of the peeling machines in use now require soft raw tails for maximum peeling efficiency.
- A. Bullis: If the red shrimp is handled and sold as are the other shrimp, it will not retain its identity or its appeal as a specialty product. If, however, care is used in handling, cooking, processing and marketing, it can meet with widespread approval, as has been demonstrated by us in local restaurants along the Gulf coast. The cooking loss is a problem in some areas since buyers feel that the specialty value cannot be high enough to cover the loss due to shrinkage in cooking. Other buyers and dealers feel that the eye and taste appeal of the red shrimp will enable it to command a premium over the species now being utilized.
- Q. Strasburger: Did you find that the red color might meet consumer resistance under the excuse that it was spoiled shrimp?
- A. Bullis: No. In all cases where trial lots were distributed, the

people were aware that this is a new species and were eager to try it. Comments have all been favorable.

Q. June: Do you have any estimate of cost for conversion to deep sea trawling for the royal red shrimp?

A. Bullis: Yes. A lot depends on where the conversion starts. If one already has a vessel with an ordinary winch, an outrigger boom and warp, one is faced with the prospect of selling this equipment and installing a deep water winch and cable, which involves an initial expense of \$1500 to \$2000 for a winch plus an added \$500 to \$1000 for wire, depending on whether single or double warp is to be used. Standard trawls and doors are used, with the addition of extra weight on the doors. An added expense would come with the need for an adequate depth recorder and Loran set. One can buy a used Loran set for \$175 or a new set for \$3500. The initial total outlay would probably run from \$4000 to \$8000. The cost of outfitting a new vessel would probably be less than re-conditioning and outfitting an old one.

Q. Levinson: For the commercial fishermen who are interested in the royal red shrimp from a production end, do you know the seasonal and geographic patterns of distribution?

A. Bullis: Yes, to a certain extent. A report is now in print which shows what we have found in the Gulf of Mexico for the years 1950-1956. We have some grounds charted and we have some data which shows the seasonal catch rates on these different grounds. In the Gulf, between the Mississippi delta grounds and the Dry Tortugas grounds, production can apparently be maintained on a year-round basis, although the winter time has a generally lower catch rate than the summer. On the east coast we haven't worked a full year and have conducted production dragging only during five months, but apparently there is a decrease in numbers of large shrimp and an increase of small shrimp in the late fall. Whether these small shrimp will reach a high enough count to be of value by February or March when the bad weather is over, still remains to be seen. A report on the East Coast findings will probably be prepared as soon as one full year of commercial type fishing has been carried out.

Q. June: What is the presently known range of this species?

A. Bullis: A single specimen was caught off Georges Bank about a year and a half ago. That is the only capture above Cape Hatteras that I know about. It would seem that southern range extends down into the Caribbean on the outside to about the Virgin Islands. This record was taken from a dredge haul made back about 1880. Large quantities of red shrimp were also caught in dredge drags off Brazil. I got that information from a captain's log while I was in

Washington. This log gave no scientific name but the description fits this species very closely. Large populations of this species are found from Cape Canaveral to St. Augustine in a small area S.W. of Dry Tortugas and east of the Mississippi delta. Some traces occur all around the Gulf of Mexico, but commercial quantities do not exist in all areas.

- Q. June: What are the maximum and minimum depths at which the red shrimp occur?
- A. Bullis: Preliminary data shows a range of 150 to 400 fathoms with 99 per cent of the captures being taken between 190 and 300 fathoms.
- Q. June: Do the red shrimp occur with any "indicator" organisms?
- A. Bullis: Not throughout the entire range of red shrimp. There are definite local faunal associations but these associated animals may be different in different areas.
- Q. Fieger: How long does it take to drop the net and to recover it in deep water?
- A. Bullis: It takes 10-15 minutes to drop 700 fathoms of wire over, and about half an hour to retrieve it. Winch speed will, of course, govern the haul-back time. We have used long drags—up to five hours—in deep water because of this lost time factor. This extra trawling time is possible due to the apparently small amount of trash found in deep water. We have found little correlation between day and night catches, so the fishing can be carried on 24-hours a day in the Gulf.
- Q. Costello: Have you records of the catch you made in pounds per hour and can you say when it is possible to fish for the red shrimp profitably?
- A. Bullis: We have tried to break down our catches into pounds per hour. We have shown how bad, how good and what our average catches have been. It must be remembered, however, that our aim has been to mark out the bounds of good and bad fishing areas, hence we have left good fishing many times to explore new areas. For this reason it is difficult to extract any estimate of commercial potentialities from our data. We have found that in the Mississippi delta area we average about 25 to 38 pounds per hour, with many individual catches much higher. The low rate is in the winter, improving to a high in the fall. The best catches in the Tortugas run about 180 pounds per hour. On the east coast for several months now we have produced close to 100 pounds per hour. We have caught up to 800 pounds of tails per day. Where the economic breaking point is I do not know. The prices will decide whether it can be a paying proposition.
- Q. Stein: Can you elaborate on your statement regarding the temp-

erature of the water where you catch these shrimp and its importance to the fishery?

A. Bullis:

We have found that without exception our good catches have been taken in water that ranges from 47°-52°F., and 210-270 fathoms. A temperature of 50°F. is apparently optimum.

Butler:
(Comment)

It might be of interest to note that the red shrimp must be headed quickly to prevent discoloration of the flesh by the exudate from the body.
