

They drop below this from January to April, reaching an average of about 74°F in March.

The pink shrimp migrates to depths less than thirty fathoms during this period. We have observed a relationship in the amount of the catches with the number of days of cold surface water below 76°F. When the surface temperature drops below this, the pink shrimp is found closer to shore and in big concentrations and catches as high as nine tons in three to four days have been reported. During the dry season of 1957 in which there were sixty days of cold water, the total catch of pink shrimp was near 3,000,000 pounds, and in 1958 when there were only eight days of cold water the catches did not reach 500,000 pounds.

Most of these shrimp caught in the dry season have ripe ovaries.

DISCUSSION

Shrimp Session

Discussion Leader: DONALD MCKEE

Discussion Panel: L. W. STRASBURGER, J. S. CARINHAS, JR., L. C. RINGHAVER,
J. C. FERGUSON, F. FRITZ KOCZY

Marking Pink Shrimp (*Penaeus duorarum*) With Biological Stains—A Field Experiment

THOMAS J. COSTELLO

- Q. Strasburger: There appear to be certain definite limitations to the use of dyes for marking shrimp. I wonder if you would give us a better evaluation of those limitations.
- A. Costello: We have only three dyes that are cleared by the Food and Drug Administration, which limits the number of experiments we can run at one time. Our chemists now are working on a method of mixing dyes so that we may have as many as seven combinations and possibly many more, so that it would be possible, for instance, to use trypan red and fast green and trypan blue independently, and then mix them so that we can have a number of combinations. Since a shrimp's life cycle doesn't exceed fourteen months we would have a possibility of making 15 or 18 combinations in the same area without any possible confusion of data. By marking a group of shrimp in a narrow size range it is possible to get growth data which will apply to that whole group. The big advantage in staining is that we can stain approximately seven times as fast as we can tag shrimp.
- Broadhead: You are talking in terms of how many more stained

- (Comment): shrimp you can put out, but from some of our tuna work we can say that the rate of return is perhaps a good deal more important than ease of tagging. I feel certain your efficiency in returning the vital stains will be at least two or three times poorer than returns of tags. We find with tuna even with a very bright tag that we were losing about 50 per cent of them, and this despite the fact that maybe ten or twelve people handle these fish individually.
- Q. Rae: Is there any evidence to show whether the colored shrimp are more, or less, likely to be taken by predators than are normal shrimp?
- A. Costello: I don't know.
- Q. Gunn: Does the Fish and Wildlife Service have a schedule for extension of the dyeing experiments?
- A. Costello: Yes, we plan a staining program down the Keys with a second color, and a third color in the closed area in the Tortugas, and in May of next year a very large staining program in Clear Lake near Galveston. We may be able to answer a few basic questions so far as natural mortality rates are concerned by injecting a large group, maybe a hundred thousand stained shrimp, in the population there.

Fish Inspection in Canada

H. V. DEMPSEY

- McKee
(Comment): The shrimp industry has recognized the need for quality control and for standards on a voluntary basis. I hope we will some day have inspections and standards for seafood products as good as yours seem to be.
- Q. Koczy: You said your inspection service cost \$1,450,000. Have you estimated how much return you get?
- A. Dempsey: One measure of the success of inspection would be an increase in the per capita consumption of fish, and another, the increased earnings to the fisherman.
As far as increased earnings to the fishermen are concerned, there has been an improvement in those ports where we have officers who grade the fish as it comes off the trawlers. Some of the major fishing companies in the Maritime Provinces are paying an incentive bonus of \$14 a trip to the icer aboard the trawler, in order to encourage the landing of a higher proportion of Grade I fish.
We measure per capita consumption by the disappearance of fish stocks, balancing off what was exported and assuming the rest was consumed in Canada. There has been a slight

increase in consumption, but not as much as we hope will be shown in the next few years.

- Q. Koczy: You talked about "subjective methods" of fish evaluation. What are these?
- A. Dempsey: Our subjective measurements are substantially the appearance, odor, and the feel of the fish.
- Q. Carinhas: Was this inspection self-imposed by the industry or was it government inspired?
- A. Dempsey: It was asked for originally by the industry about eight or ten years ago.
- Q. Carinhas: How is this service paid for?
- A. Dempsey: By the Canadian taxpayer. There is no charge to the industry at all.
- Q. McKee: Is inspection mandatory in all fish processing plants?
- A. Dempsey: Certain types of inspections are mandatory: canned salmon, canned herring and all pickled fish, smoked fish, bloaters and similar products. At the present moment the inspection of fresh and frozen fish and the inspection of fresh fish processing plants is voluntary. The compulsion will come about, under our new program, through the insistence of the buyers—the chain stores and supermarkets for example—that the fish they purchase be of "Canada Inspected" grade and quality. In a sense we are acting as a referee between the buyer and the seller.
We are working towards national compulsory inspection of fish and fish processing plants, and the new "Canada Inspected" program which begins on the first of April will be a forerunner of compulsory inspection, within possibly the next two or three years.
- Q. Ringhaver: You said that 65 per cent of the fish is exported. What are the principal nations you export fish to?
- A. Dempsey: Of our fresh and frozen fish, 99 per cent of our exports go to the United States. Canned fish goes all over the world.
- Q. Ringhaver: Do you inspect imported fish?
- A. Dempsey: We have compulsory inspection of all imports of canned fish and shellfish coming into Canada. We have not yet had the time or the man power to make as close a check of packaged and frozen fish and shellfish as we would like.
- Q. Strasburger: In regard specifically to canned shrimp which is imported in some quantity into Canada, it is my understanding that your most serious trouble with the product has been short weights. Do you mind outlining your method of weighing of a can of shrimp?
- A. Dempsey: First of all, in examining any lot of canned shellfish, whether domestic or imported, we pay no attention to overweight

cans. Canned shrimp is first allowed to come to room temperature, around 68 to 75 degrees. The cans are opened and then allowed to drain from one to one and a half minutes, the shrimp are emptied onto a scale and weighed. If we find more than 25 per cent of a sample is over 1/10 of an ounce short weight we deem the entire lot to be short weight.

Q. Strasburger: Your method of determining the drained weight of the shrimp is at variance with the United States method set up in this country of draining the shrimp on a previously tared 8-mesh sieve. The sieve is then weighed and the exact weight of the shrimp is obtained.

Actual experimentations which I have carried out show that the United States' method will give from 14 to 28/100 of an ounce difference in one can between the two methods. Consequently, shrimp which are marketed in this country and which may be labeled as "five ounces" may be short weight if marked "five ounces" in Canada.

A. Dempsey: We have done a little work on this ourselves because we want to be practical and fair. We have come to the conclusion that, with our method of weight determination, any error is in favor of the canner. So far as the two methods are concerned it is hard to convince us that any difference between the two methods of measurement will account for short weights of over one-third of an ounce per can, which we often find.

Q. Hess: Mr. Strasburger, from the figures given the storage temperature in the United States' method of determining drained weight may be higher, and the length of draining longer, so theoretically one would expect more of the liquid to drain off and obtain therefore a relatively lower drained weight.

A. Strasburger: The amount of moisture which clings to the meshes of the sieve probably accounts for the differential.

Q. Saenz: Would you comment as to the value of putting the date of packing on a frozen food package so that the consumer may have an idea of the length of storage time of this product?

A. Dempsey: We are completely opposed to that. In our new inspection standards we provide for marking the date on containers or wrappers, but it is in code. Human nature being what it is, if the housewife is offered, for example, two packages of frozen halibut, one package marked May 15 and the other package marked May 30, she will buy the May 30 package. She is assuming that she is getting a fresher fish when, in fact, she may not be.

Q. Bullis: What percentage of your fish receiving plants have inspectors?

A. Dempsey: We have an inspector in every processing plant which will meet our standards. In some instances we have two inspectors, where plants are working double or triple shifts.

Sizes of Shrimp Caught and Distribution of Fishing Effort on the Tortugas Grounds

ANDREW E. JONES AND EDWIN S. IVERSEN

- Q. Ferguson: During the summer months with fifty or sixty trawlers on the grounds the relationship between the size of shrimp and depth was more pronounced than in the winter months with 500 or 600 boats on the grounds. Do you think that the large fleet of boats may have scattered the shrimp?
- A. Jones: The extreme dispersal of small shrimp in September and October I would say was not caused by the boats. Apparently the shrimp spread quickly over the grounds at that time.

Progress in Biological Research on the Tortugas Shrimp

EDWIN S. IVERSEN AND C. P. IDYLL

- Q. Strasburger: In attempting to gather statistics on a purely voluntary basis as you have done, have you gotten cooperation from the industry or have you found certain individuals who don't want to give you the information you are seeking?
- A. Iversen: Some people do not want to show their records and we have not yet gotten some records we would like to have had. The same thing has happened in the case of tagging. We know that some fishermen have thrown away tags. This is very unfortunate and hurts the fishermen themselves. Each returned tag is of great value to the program. On the whole, fortunately, we are getting good cooperation from the industry.
- Q. Ramirez: We have a problem in Mexico. A certain type of gear is used to prevent the small shrimp from getting out of the lagoon to the sea. What effect would that have on the shrimp?
- A. Iversen: If you block the exit of the young shrimp from the brackish water nursery grounds you take something away from the fisheries. How much you lose in large shrimp later depends on the rate of death of the shrimp in the meantime, balanced against the rate of growth. Before your question can be answered we must study these rates; this is essentially the basis of our research.
- Q. Ferguson: Since the closed area on the Tortugas grounds has been enforced by the Florida Conservation Department we have noticed quite an increase in our catches. I would like to know if the research indicates whether these are cause and effect.

- A. Iversen: We are unable with our present information to judge whether this year's improved catches were produced by the closed area. There is a fifty-fifty chance that they will be better in any one year compared with the previous year. We do not yet have the scientific information to base a decision on.

The Territorial Waters Dispute and the Shrimp Industry

WILLIAM R. NEBLETT

- Q. Ringhaver: How is the Continental Shelf determined?
- A. Neblett: The legal definition of the Continental Shelf is the submerged land out to 200 meters depth, or to the limits of exploitability.

A Survey of the Shrimp Fishery of Panama

JUAN L. OBARRIO

- Q. Galtsoff: It appears that the abundance of shrimp in Panama is correlated with the degree of ocean upwelling. Have you any theories as to how the upwelling affects the life of shrimp or other organisms in the Gulf of Panama?
- A. Obarrio: Whenever the number of cold days is higher, the catch of shrimp is higher. This upwelling is caused by a north wind that pushes the waters up the coast and causes the lowering of the sea level, so that offshore water from the bottom, which is colder, comes to the coast to replace this water that was blown offshore. This appears to bring the shrimp within range of the boats.
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