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PRELIMINARY STUDIES ON TEMPERATURE ASSESSMENT OF FISH AT ALL STAGES IN THE DISTRIBUTION CHAIN*

By

S.V. BERSAMIN and E.P. TONGCO

ABSTRACT

Fragmentary investigation had been done in the problem of the quantity and the quality of ice needed to service the fresh fish industry and the temperature at which fish should be maintained under existing climatic condition until it reaches the consumers in fresh and acceptable condition. The authors conducted a survey of fish caught by basnig and purse seines which were iced after brailing and exposed for sale at the Navotas Fish Market in Navotas, Rizal, from August to October 1965. The present fish handling practices stands a lot of improvement. Under existing local conditions, it would be more economical to use insulated and standardized fish containers like fish boxes with enough holes for proper drainage. This will insure proper preservation of the catch and stabilize current fish prices.

INTRODUCTION

The increasing demand for fish as a cheap source of protein has encouraged fishermen to develop effective fishing gear and explore potentially rich fishing grounds. The development of basnig, mechanized purse seine and the expansion of off-shore fisheries have increased the annual fish production tremendously. Increasing the landings alone, however, would not remedy nutritional and economic problems unless special attention is given to the improvement of fish handling. The fishing industry is faced with multifarious problems among which are the quantity and quality of ice needed to service the fresh fish industry and the temperature at which fish should be maintained under existing climatic conditions until it reaches the consumers in a fresh and acceptable condition. Fragmentary field work on fish handling have been done and the data so far gathered would

* Presented to IPFC 12th Session, 1966.

not suffice to make an evaluation of the conditions of iced fish and subsequent temperatures at various stages in the distribution chain.

REVIEW OF LITERATURE

Shewan, (1951), in his work at the Torry Research Laboratories, found that spoilage is accelerated with increases in temperature. Similar investigations conducted by Canadian workers (Castell, *et al*) show that the rate of multiplication of bacteria increases with higher temperatures. G.E. Reay, (1959), concluded that fish spoils about two and a half times faster at 4.4°C and about five times faster at 10°C than at 0°C. Shewan further reported that fish kept in iced boxes at high ambient temperatures spoiled after 2 days while those kept in iced boxes held at 0°C lasted longer.

MATERIALS AND METHODS

Tamban (*Sardinella longiceps*) and *galonggong* (*Decapterus macrostoma*) were the species studied. The survey was carried out at the Navotas Fish Landing, Navotas, Rizal, from the middle of August to the latter part of September. Some 1250 fish samples were taken from basnig and purse seine boats operating at the offshore fishing grounds of Palawan and Zamboanga. Attention was given to load and batches that were exposed for sale at the Central Fish Market in Navotas, Rizal. In this study, one mercury-in-glass thermometer and a Torry resistance thermometer were used. Fish temperatures were taken by pushing the probe through the lateral side from the tail section up to the thickest muscle just behind the head of the fish so that the probe lies parallel to the backbone. By burying the probe at least 4 inches into the fish flesh, error in measurement due to heat leakage is minimized. Fish samples from standardized circular-shaped metal containers were picked at random from the top, sides, middle and bottom. Average of all temperature readings represent the temperature of all the fish in the tub. Conditions of icing were observed and sensory assessment of the fish were also conducted.

RESULTS AND DISCUSSIONS

In Table I, the lowest average temperature (7.9°) was taken from the bottom of the tub while the highest averages encountered were those taken from the two sides, 12°C and 10°C, respectively.

TABLE I. Variation of temperature of fish taken from containers exposed for sale at the Navotas Fish Market.

Temperature Range °C	Top	Left Side	Right Side	Middle	Bottom
	Per Cent of Readings				
2-6	29.5	19.13	29.13	48.26	41.74
7-11	33.04	27.39	30	25.22	39.13
12-16	23.48	32.61	23.04	12.70	17.83
17-21	10.87	16.96	16.09	6.52	1.30
22-36	3.04	3.91	1.74	1.30	0-
Number of Readings	230	230	230	230	230
Average Fish Temperature °C	10.25°C	12.0°C	10.6°C	8.3°C	7.95°C

At an average ambient air temperature of 31°C during the whole period of the survey starting from August to October of 1965, the assumption was that, fish rapidly warms up from the sides during exposure. High ambient temperature of the tropics and inadequate icing explain such temperatures encountered in locally iced fish.

Melted ice accumulated at the bottom of the container which are not provided with any drainage. This cools the fish and explains why the fish at the bottom has the lowest average (7.9°C) among the various temperatures studied.

The present fish handling practices stands a lot of improvement. Some fish operators still doubt whether a method of stowing fish to keep them cool in tubs, with almost all the sides of the fish in contact with ice and fully utilizing melted ice to wash off blood and slime could be attained. Obviously, there are measures of keeping down the fish temperatures to keep them cool while exposed for sale. One method is to repack a well mixed fish and ice in a fresh clean tub. This requires a considerable amount of time and labor. Another is by heavy top-icing to prevent the fish from rapidly warming up. These are some of the ways of extending the shelf-life of iced fish.

A practical and more realistic approach to the fish handling problem is to provide an entirely improved fish container that will

eliminate all the inconveniences of the tubs used at present. From the workers' point of view and as far as efficient icing of fish is concerned, the tubs should be made more shallow so that the weight of ice would be just sufficient to keep the fish cool and would not bring damage to the fish whether the tub is topped or mixed. It should also have sufficient drainage holes so that melted ice could wash off fish blood and slime which harbor spoilage bacteria.

It is the normal practice of fishermen to place their catch in tubs immediately after brailing. A tub contains approximately 30 to 35 kg. of fish minus the ice. No proportion of ice is observed, a practice which existed with the growth of the industry. As soon as ice is spread haphazardly over the fish in the remaining space on top of the tubs, they are then stacked on the fish holds of the boats or may remain on deck awaiting transfer to carrier boats.

Additional icing is not done for the duration of the trip. It is obvious that at the time fish reaches the unloading port, a scanty ice topping is what remains to cool the fish with water, blood and slime filling almost half of the tub. Unloading is a long process, consuming about an hour for a batch of 100 tubs. Loading and unloading in amphibian trucks is done to negotiate a 2 kilometer distance from the anchorage to the fish market. Fish unloading commences at around 2200 hours and lasts till 0500 hours the following morning. These tedious process allow fish temperature to go up considerably after the fish leaves the holds and while they are exposed for sale in the market.

Fishing boat operators should realize the need for a sufficient stock of ice, especially bactericidal ice to meet their requirements throughout the duration of the trip. For adequate icing, alternate layers of crushed ice and fish with similar thickness should be used. Re-icing should be done when necessary. Under existing local conditions, it would be more economical to use insulated and standardized fish containers like fish boxes with proper drainage. This will insure the proper preservation of the catch and stabilize current market prices.

SUMMARY

The primary object of this study is to determine the general pattern of fish temperature during transport from the fishing grounds and throughout all stages in the distribution chain until it reaches

the consumer. The present report is confined to the temperatures of fish caught by basnig and purse seines after unloading from the vessel and exposed for sale at the fish landing. With trips being made longer, an effective cooling system is necessary to maintain a consistently low temperature.

Basnigans usually operate individually at an average of 15 days per trip and the journey to and from the fishing ground consumes about three days, so that the fish at unloading would be around 12 days old, more or less. Purse seiners operating with a fleet of carriers may consequently have their catch averaging from 3 to 5 days at unloading. This assumption is based on carriers commuting daily from the fishing ground to the port of unloading. For con-

TABLE II. Variation of Temperature of Fish Exposed for Sale at Navotas Fish Landing, August to October 1965.

Temperature °C	Per Cent of Readings	
	Purse Seine	Basnig
1-1.5	.45	0
2-2.5	0	0
3-3.5	1.8	3.24
4-4.5	4.5	22.6
5-5.5	6.75	6.28
6-6.5	9.45	16.2
7-7.5	8.55	16.2
8-8.5	9.1	6.48
9-9.5	8.18	12.9
10-10.5	8.55	6.48
11-11.5	5.9	3.24
12-12.5	6.36	3.24
13-13.5	6.81	0
14-14.5	8.18	0
15-15.5	6.36	3.24
16-16.5	3.18	0
17-17.5	1.8	0
18-18.5	.45	0
19-19.5	.45	0
20-20.5	.45	0
26-26.5	2.27	0
Number of readings:	1,100	150
Average fish temp.:	10.5°C	7.4°C

venience, basnigans now operate with carriers so that it could be assumed that basnig and purse seine-caught fish are about the same age at unloading.

The survey started from the middle of August to the latter part of October, 1965 and a total of 1,250 fish samples were examined from tubs exposed for sale at the Navotas Fish Landing. Condition of icing and sensory assessment of the fish samples were also conducted. Fish temperatures were taken with the use of the Torry resistance thermometer.

The averages of all readings for fish at the Navotas Fish Market caught by purse seines was 10.5°C and those landed by basnigans was 7.4°C. Under this condition the fish would be virtually unfit for table fare, after 2 days and condemnable after 3 days. Handling practices in Philippine markets do not follow specific proportion of ice to fish. Moreover, temperature is not a guide in their icing procedures.

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