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Storage Life of Silverbelly (Leiognathus Sp.) with delayed Icing

By

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Introduction

Silverbelly (*Leiognathus* sp.) is a by-catch species caught in large numbers in prawn trawling. A fair amount of work has been done and is presently being carried out at the Institute of Fish Technology (I.F.T.) on utilization of Silverbelly. A fish meal, fish silage, and a salted dried product for human consumption, have been prepared. Therefore it was necessary to find out about the keeping quality (storage life) of iced Silverbelly, especially as utilization for human consumption was under consideration. Ice is expensive and the ice taken on the trawlers (most of which are small and cannot carry much ice) are used exclusively for prawns. It is essential that the raw material for Fish Protein Concentrates (FPC) is fresh. Therefore it was important to study the spoilage pattern of Silverbelly when kept under different conditions, especially to find out the maximum time icing could be delayed.

Two experiments were carried out at the I.F.T., the first in May 1978 (carried out by D. de Alwis and A. Villadsen) and the second in September 1978 (carried out by V. Jayaweera, T. de Silva and M. A. B. Jansen), to determine the storage life of iced Silverbelly and the effect of delayed icing on Silverbelly.

Materials and Methods

Samples for both experiments were brought from Mannar. The catch, in one haul, was very large in May (about 600 lbs) whereas in September it was very small (100 lbs). In the first experiment (May) 3 samples of fish were iced, after 3½ hours, 6 hours and 12 hours from landing on board. In the second experiment (September) 4 samples of fish were iced with 1½ hours, 4 hours, 8 hours and 12 hours delay. On both occasions the fish were kept in ice at 0°C throughout the experiment. The decline in quality was followed organoleptically (taste panel), chemically (total volatile bases) and bacteriologically (total plate counts).

TABLE 1

DELAYED ICING OF SILVERBELLY CAUGHT IN MAY AND SEPTEMBER

Experiment I (May)		*Experiment II (September)*	
Delay in Icing	*Group*	*Delay in Icing*	*Group*
3½ hrs	I	1½ hrs	A
6 hrs	II	4 hrs	B
12 hrs	III	8 hrs	C
		12 hrs	D

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Taste Panel Assessments

The Silverbelly were gutted and cooked at 90° C for 10 minutes in a 2% salt solution, and judged by each panel member for odour, flavour, texture and overall quality. A 0—10 HEDONIC scale was used where the limit of acceptability is 4.

Total Volatile Bases

The Conway-Byrnes method (Beatty and Gibbons, 1937) was used to determine Total Volatile Bases (TVB) and Trimethylamine (TMA). Sampling was done in duplicate.

Sampling in Experiment I — 25g fish and 75 ml water was used to make the required samples of 100g.

Sampling in Experiment II — Two 100g samples were taken from a mixture of 150g fish and 450 ml water.

Bacteriological analysis

Fish (10g) were weighed aseptically into a sterile blender jar (MSE homogeniser), sterile peptone water (90 ml) was added and the contents homogenised for 30 seconds. Tenfold serial dilutions were made and 1 ml mixed with Nutrient Agar and incubated as follows , in duplicate:

Experiment I — 30°C/3 days and 20°C/5 days

Experiment II — 30°C/3 days and 10°C/7 days

Results

The results of taste panel assessments are given in Tables 2 and 3 and shown graphically in Fig. 1. TVB and TMA values are given in Tables 4—7 and shown graphically in Fig. 2. Results of the bacteriological analysis are given in Tables 8 and 9 and shown graphically in Fig. 3.

DISCUSSION

The results of the Taste Panel Assessments (Tables 2–3 ; Fig. 1) in both experiments show the quality of Silverbelly which were iced 12 hours after landing (Groups III and D) had deteriorated beyond the limits of acceptability score of 4, even on the very first day in ice. Group II in experiment I gave a score below the acceptable limit only after the 13th day in ice. No assessments could be carried out on the 14th day for the fish in Group I ; however, by extrapolating the graph it is expected that the quality of this fish would still remain just acceptable on the 13th day. There was no significant difference on a 95% probability level between the fish of Groups I and II throughout the experiment.

In experiment II the fish in Group C kept between 2 and 5 days, and there was no difference in the quality and storage time for fish in Groups A and B, both which kept at an acceptable level for 8 days. The difference in quality was not significant on a 95% probability level between Groups A and B ; but it was significant between Groups A and C, B and C and D and C.

On comparing the results of the 2 experiments, the 12 hr. delayed icing (Groups III and D) was in agreement. There is a similarity in the spoilage pattern between Groups I, II in Exp. I and Groups A, B in Exp. II. But the keeping time is less in Exp. II (8 days) than in Exp. I (13 days). This difference in keeping time could be due either to faster spoilage, which might be caused by seasonal changes,or physical damage, due to bad handling and greater trawling time, in the September catch.

The catch in May was about 6 times greater than the catch in September ; this may indicate a seasonal change in the catch. The taste panel scores on the first day of fish in Groups I and II (Exp. I) are 7.0 and 6.8 respectively and are almost identical with the fish in Groups A and B (Exp. II) which are 7.1 and 6.8 respectively. Therefore the difference in keeping time cannot be due to physical damage, in which case the initial scores would not be identical. A fair number of fish in Group D (Exp. II) showed belly burst whereas there was hardly any belly burst in Group III (Exp. I) even after 3 days which indicates that the fish caught in September spoilt faster. The difference in keeping time therefore seems to be due to faster spoilage, which might be brought about by seasonal changes, and not physical damage. A similar phenomenon has been observed in Plaice and Cod caught in two seasons, where the keeping time was less in one season (Anon., 1972).

Content of Total Volatile Bases (TVB—measured as nitrogen) has in general been found a rather unsatisfactory indicator of spoilage (Borgstrom 1965). But Yamamura and Tanikawa found the content of TVB useful as a measure of spoilage. The TVB test has been found valuable with regard to cod-type fish, and is regarded to be good for more advanced stages of spoilage and not sensitive enough to detect the incipient stage (Borgstrom 1965).

The TVB values (Table 4 ; Fig. 2) in Exp.I cannot be correlated with the taste panel score. In Exp. II the TVB values (Table 5 ; Fig. 2) of fish in Groups A and B rise gradually up to day 8 (limit of acceptability) after which there is a sharp increase in TVB. The reason for the irregularity of TVB results in Exp. I is the non-uniformity of the sample. In the second experiment a larger sample was used, thus obtaining a more uniform sample. A similar TVB curve has been obtained for packeted mince silverbelly (Guneratne, 1978). For silverbelly TVB could be used as a measure for spoilage. In both experiments the TVB value at the limit of acceptability (Score 4) is between 30–40 mg N/100g sample. Yamamura and Tanikawa have suggested 30mg N/100g as the upper limit of acceptability for some species (Borgstrom 1965).

The TMA values (Tables 5—6; Fig. 2) do not seem to indicate spoilage or freshness of Silver belly.

There is little difference in the bacterial counts (Table 8 : Fig. 3) in Exp. I where the incubation-temperatures were 30° C and 20° C There is also hardly any difference in Exp. II (Table 9 : Fig. 3) where the incubation temperatures were 30° C and 10° C. Therefore no conclusion can be drawn on the growth of psychrophilic bacteria which are the main spoilers of fish in ice. Bacterial counts do not seem to be a good measure of freshness or spoilage of Silverbelly.

From the results of both experiments it could be seen that the deterioration in quality of fish with 3½ hrs. and 6 hrs. delay in icing (Groups I and II) were similar ; also fish with 1½ hrs. and 4 hrs. delay in icing (Groups A and B) were similar, but the deterioration in quality of fish with 8 hrs. delayed icing (Group C) was different. Therefore even though there is a difference in storage time for the two experiments the spoilage pattern is similar and it seems that the main spoilage for Silverbelly starts between 6 and 8 hrs. at ambient temperature (28° C—30° C). Therefore it would appear that it would suffice if the icing could be done before 6 hrs. has lapsed after landing on board.

SUMMARY

Silverbelly caught in September spoilt faster than the fish caught in May. This could be due to seasonal changes. For Silverbelly Total Volatile Base (TVB) value could be used as a measure of spoilage. At the beginning of spoilage TVB value is between 30–40 mg. N/100g. sample.

The main spoilage for Silverbelly appears to start between 6 and 8 hours (at 28° C–30° C) after landing on board. Therefore it is not necessary to ice Silverbelly immediately and it seems to be sufficient if icing can be done within 6 hours of landing on board.

ACKNOWLEDGEMENTS

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TABLE 2

TASTE PANEL SCORES OF SILVERBELLY CAUGHT IN MAY

No. of Days in Ice	*Taste Panel Score*		
	Group I 3½ *hrs. delayed icing*	*Group II* 6 *hrs. delayed icing*	*Group III* 12 *hrs. delayed icing*
1	7.0	6.8	1.8
4	6.6	6.3	—
7	6.2	5.8	—
12	4.6	4.3	—
14	—	3.3	—

TABLE 3

TASTE PANEL SCORES OF SILVERBELLY CAUGHT IN SEPTEMBER

No. of Days in Ice	*Taste Panel Score*			
	Group A 1½ *hrs. delayed icing*	*Group B* 4 *hrs. delayed icing*	*Group C* 8 *hrs. delayed icing*	*Group D* 12 *hrs. delayed icing*
1	7.1	6.8	4.5	1.4
2	—	6.3	3.7	—
5	5.6	5.9	4.1	—
8	4.0	3.8	2.0	—
12	2.6	2.4	—	—

TABLE 4

TOTAL VOLATILE BASE VALUES OF SILVERBELLY CAUGHT IN MAY

No. of Days in Ice	*Total Volatile Bases (mg/100g sample)*		
	Group I 3½ *hrs. delayed icing*	*Group II* 6 *hrs delayed icing*	*Group III* 12 *hrs. delayed icing*
1	13.57	37.56	139.78
4	23.01	25.19	143.40
7	18.96	19.09	—
12	21.65	24.78	—
14	—	35.62	—

TABLE 5

TOTAL VOLATILE BASE VALUES OF SILVERBELLY CAUGHT IN SEPTEMBER

No. of Days in Ice	*Total Volatile Bases (mg/100g sample)*			
	Group A 1½ *hrs. delayed icing*	*Group B* 4 *hrs. delayed icing*	*Group C* 8 *hrs. delayed icing*	*Group D* 12 *hrs. delayed icing*
1	9.44	11.76	27.19	68.17
2	—	—	51.40	—
5	27.30	30.55	55.63	—
8	31.44	32.10	58.01	—
12	77.62	68.38	—	—

TABLE 6

TRIMETHYL AMINE VALUES OF SILVER BELLY CAUGHT IN MAY

No. of Days in Ice	*Trimethyl Amine (mg/100g sample)*		
	Group I 3½ *hrs. delayed icing*	*Group II* 6 *hrs. delayed icing*	*Group III* 12 *hrs. delayed icing*
1	7.94	13.53	27.90
2	12.64	13.61	85.55
7	2.64	2.70	—
12	0.00	0.00	—
14	—	9.20	—

TABLE 7

TRIMETHYL AMINE VALUES OF SILVERBELLY CAUGHT IN SEPTEMBER

No. of Days in Ice	*Trimethyl Amine (mg/100g samples)*			
	Group A 1½ *hrs. delayed icing*	*Group B* 4 *hrs. delayed icing*	*Group C* 8 *hrs. delayed icing*	*Group D* 12 *hrs. delayed icing*
1	0.33	1.65	2.97	10.23
2	—	—	8.41	—
5	1.25	2.56	2.56	—
8	1.59	2.58	7.17	—
12	7.33	5.70	—	—

TABLE 8

TOTAL PLATE COUNTS AT 30° C AND 20° C OF SILVER BELLY CAUGHT IN MAY

No. of Days in Ice	*Log Total Plate Count*					
	Group I 3½ *hrs. delayed icing*		*Group II* 6 *hrs. delayed icing*		*Group III* 12 *hrs. delayed icing*	
	30°C	20°C	30°C	20°C	30°C	20°C
1	5.27	5.29	5.94	6.19	6.54	6.39
4	5.36	5.21	6.12	5.91	6.40	6.06
7	5.73	5.94	6.05	6.11	—	—
12	—	8.65	—	8.70	—	—
14	—	—	9.06	9.43	—	—

TABLE 9

TOTAL PLATE COUNTS AT 30° C AND 10° C OF SILVERBELLY CAUGHT IN SEPTEMBER

No. of Days in Ice	*Log Total Plate Count*							
	Group A 1½ *hrs. delayed icing*		*Group B* 4 *hrs. delayed icing*		*Group C* 8 *hrs. delayed icing*		*Group D* 12 *hrs. delayed icing*	
	30°C	10°C	30°C	10°C	30°C	10°C	30°C	10°C
1	5.19	5.03	5.58	5.42	6.17	5.36	7.07	5.74
2	—	—	—	—	6.26	5.87	—	—
5	6.27	6.38	6.51	6.42	6.67	6.28	—	—
8	8.48	7.62	8.21	7.60	9.59	8.27	—	—
12	8.18	8.51	8.28	8.57	—	—	—	—

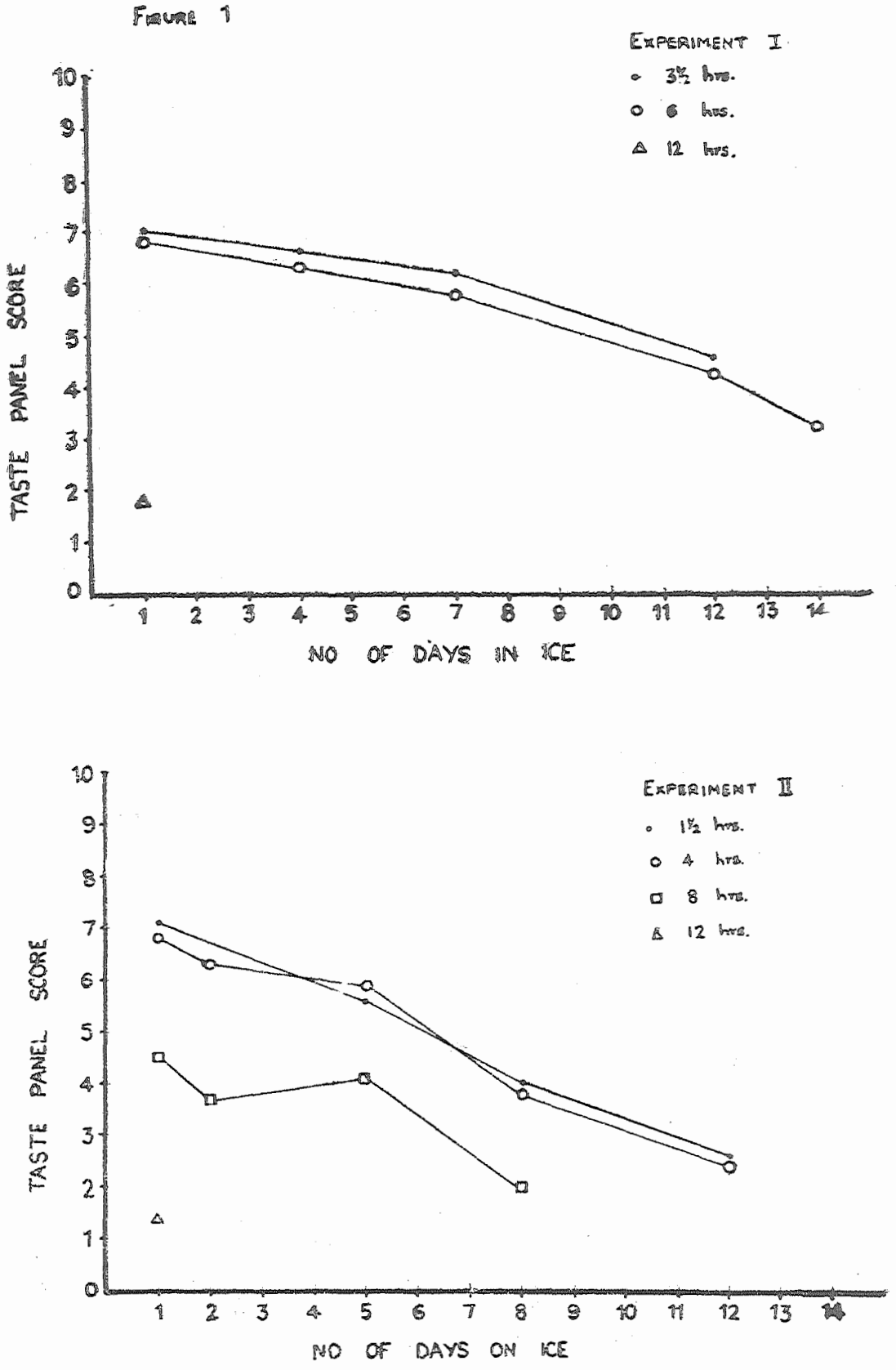

Figure 1—Taste Panel Scores of Silverbelly caught in May and September.

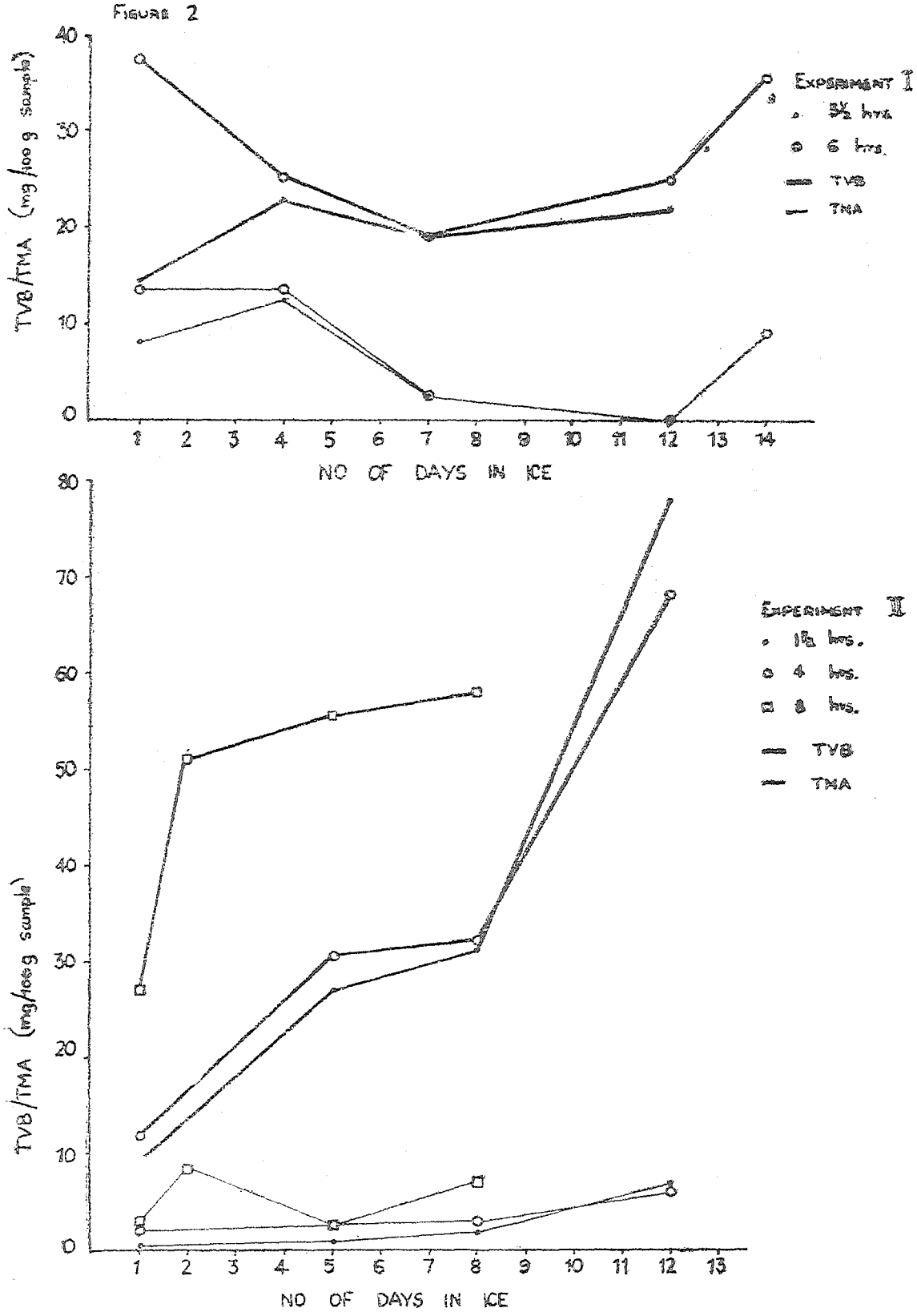

Figure 2.—TVB and TMA results of Silverbelly caught in May and September

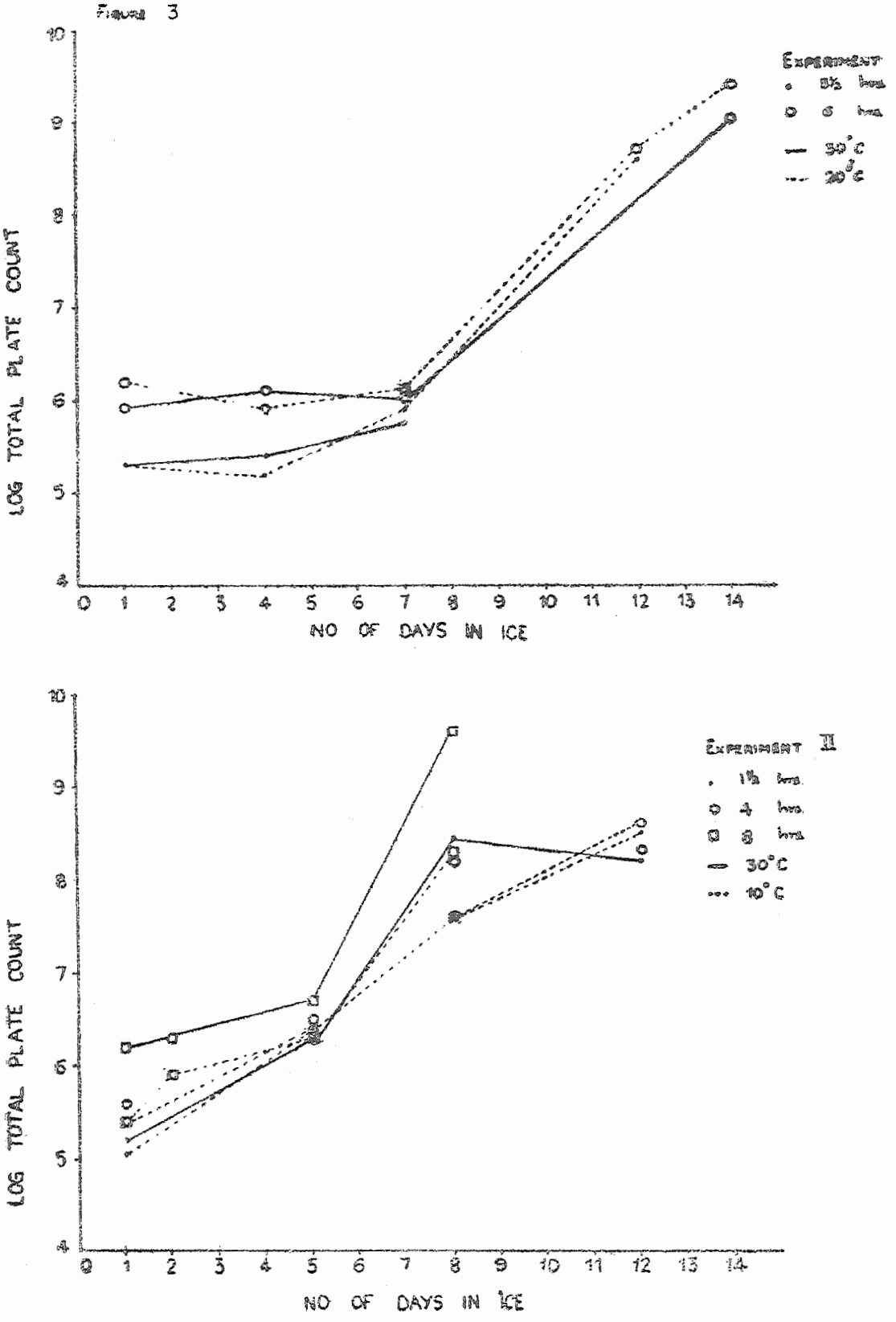

Figure 3.—Bacteriological counts of Silverbelly caught in May and September