PART II

SCIENTIFIC AND TECHNICAL

EFFECT OF BOX STOWAGE ON QUALITY OF FISH*

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Quality of boxed cod and haddock was compared with that of penned fish in terms of organoleptic grading, trimethylamine values, Intelectron Fish Tester readings and fish and fillet yield. Boxed fish showed a higher percentage of grade one fish than penned fish. TMA values, however, did not differ greatly. There was less physical damage due to squeezing with boxed fish and consequently a greater yield of landed round fish and fillets.

INTRODUCTION

With the introduction of large fishing vessels operating in distant water for longer periods stowage methods assume considerable importance. With the ambitious expansion programmes conceived by the fisheries industry in India, it is worthwhile to think ahead on the method of choice for stowage to enable introduction of suitable lay out in the vessels.

There are three principal methods of stowage of fish namely, bulking in pens, shelfing and boxing (Burgess, *et al.*, 1965). Bulking in pens is the mainly used method while shelfing is employed for stowing the catch of the last few days.

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Boxing was widely practised in the North Sea fleets in the last century. However, with the opening up of the distant water fishery at the beginning of this century this practice was abandoned. In recent years its introduction is being reconsidered for stowing fish near as well as distant water vessels.

In the present paper quality of iced boxed Atlantic cod and haddock is compared with fish bulked in shelved pens with ice.

Experimental

The fish were stored in pens and in boxes under observation of a member of the laboratory staff and on reaching port they were separated into lots of 100 each. Assessment for quality was made organoleptically by Fisheries Officers of the Inspection Branch of the Department of Fisheries, using the grading system normally used for inspection of round fish landed by the Atlantic trawler fleet. This system consists of three grades: Grade I - top quality fish; Grade II - slightly lower than Grade I but good quality; Grade III - fish which are not suitable for human consumption. The Intelectron Fish Tester V and the trimethylamine test (Dyer, 1950) were also used for quality comparisons. Yield of fish and fillets from boxed and penned fish was also calculated.

Results and Discussion

Organoleptic quality evaluation

As shown in Table I, in all cases except one the fish held in boxes had a higher percentage of grade I fish. In several cases the difference is large. The boxed haddock landed in October, 1966 were 90% grade one and 10% grade two

Table I
Grading of fish by Fisheries Inspectors

Month of catch	Species	Stowage period	Grading by Inspectors (%) Boxed fish I	Boxed fish II	Penned fish I	Penned fish II	Penned fish III
October, 1966	Haddock	7 days	90	10	52	48	—
November, 1966	Haddock	4 days	99	1	94	6	—
December, 1966	Cod	6 days	94	6	100	—	—
May, 1967	Cod	5 days	100	—	55	45	—
June, 1967	Cod	9 days	100	—	17	83	—
June, 1967	Cod	6 days	100	—	99	1	—
July, 1967	Cod	7 days	46	56	—	66	34
July, 1967	Cod	7 days	60	40	13	87	–
August, 1967	Cod	8 days	93	7	50	50	—

TABLE II
TMA values for boxed and penned fish

Month of catch	Species	Stowage period	TMA-N mg% Boxed fish	Penned fish
October, 1966	Haddock	7 days	2.67±0.56	2.70±0.70
November, 1966	Haddock	4 days	0.26±0.04*	0.48±0.70
December, 1966	Cod	6 days	2.80±0.43*	1.07±0.11
May, 1967	Cod	5 days	0.54±0.31*	1.17±0.17
June, 1967	Cod	9 days	2.33±0.29	2.55±0.19
June, 1967	Cod	6 days	1.04±0.13	1.22±0.13
July, 1967	Cod	7 days	2.25±0.35*	3.64±0.28
July, 1967	Cod	7 days	2.57±0.21	2.66±0.18
August, 1967	Cod	8 days	6.57±0.41	4.14±0.36

*Differences significant at 95% level.

while fish from the same lot held in pens were only 52% grade one and 48% grade two. The boxed cod landed during May and June 1967, was all grade one while the fish held in pens was 55, 17 and 99% grade one. In July, with the coming of warmer weather the quality of both lots of fish suffered; however, the boxed fish were 46 and 60% grade one while one lot of penned fish had none in grade one and the other had only 13% grade one. The one landing where the percentage of grade one fish was larger in the penned fish was in December 1966, when both lots of fish were of excellent quality, the boxes containing 94% grade one and the pens 100%.

Trimethylamine (TMA) values

Table II gives the TMA values for boxed and penned fish for nine landings. It does not appear that storage of fish in boxes has any large effect on the TMA values of the fish on landing, in five of the landings there is no significant differences at the 95% level in the TMA's of boxed and penned fish. Of the remaining four cases, the penned fish have the higher TMA's in three and the boxed fish in one. Since there is no difference in storage temperature, it would not be expected that a large difference in TMA value would exist.

Intelectron Fish Tester V readings

The Intelectron Fish Tester V gives a relative measurement of muscle damage due to physical mishandling and tissue breakdown due to bacterial and enzymic activity. Table III shows that in all cases the fish stored in boxes had higher readings than those held in pens. The fish

TABLE III

Intelectron Fish Tester V readings on boxed and penned fish

Month of catch	Species	Stowage period	Fish Tester readings	
			Boxed fish	Penned fish
October, 1966	Haddock	7 days	67.3±1.9	41.9±2.4
November, 1966	Haddock	4 days	80.2±1.6	49.8±3.3
December, 1966	Cod	6 days	67.1±2.2	55.8±1.7
May, 1967	Cod	5 days	69.7±1.7	42.0±2.0
June, 1967	Cod	9 days	71.5±1.5	45.8±1.7
June, 1967	Cod	6 days	78.1±1.3	54.0±2.2
July, 1967	Cod	7 days	64.6±1.2	44.9±1.5
July, 1967	Cod	7 days	54.8±2.7	43.0±1.4
August, 1967	Cod	8 days	59.9±1.8	45.4±1.6
		Average	68.1	46.95

held in pens are subject to pressure from the fish stored above them. In many cases the appearance of the fish showed the effect of this pressure as these fish were squeezed and partially flattened. Fish for this study were taken from the middle level of the pens and although the use of shelfboards is supposed to prevent extra pressure on the fish, in many cases these appeared to be ineffective. The boxed fish were packed no more than 25 cm. deep, thus the pressure on the lower fish becomes negligible. The average fish tester reading for boxed fish was 68.1 while penned fish scored an average of 46.95.

Yield of fish and fillets

Boxed fish, as seen from Table IV, was also shown to be superior to pen stored fish in the matter of yield of landed fish and yield of fillet cut from these fish. Boxed fish, in these tests, landed between 97.98 and 99.81% of the caught weight of fish compared with between 93.52 and 97.96% for penned fish. The yield of fillets was also higher. Based on the landed weight of fish the fillet yield for boxed fish was between 39.37 and 44.0% compared with between 39.12 and 42.82 for pen stored fish; however, a much larger number of samples would have to be investigated to permit an accurate estimate savings due to increased fillet yield as in these tests the increased yield of boxed fish varied over rather wide limits, between 0.15 and 4.42%.

Thus, it appears that boxed fish has a much better appearance than pen stored fish and as graded by the Inspectors of the Department of Fisheries of Canada

TABLE IV

% Yield of fish and fillets from boxed and penned fish

Lot No.		Boxed fish % yield	Penned fish % yield	Difference %
1	A	39.16	37.81	1.35
	B	39.37	39.22	0.15
	C	99.46	96.39	3.07
2	A	42.77	40.05	2.72
	B	43.04	42.82	0.22
	C	99.38	93.52	5.86
3	A	44.27	39.15	5.12
	B	44.40	39.98	4.42
	C	99.71	97.96	1.75
4	A	41.47	—	—
	B	42.38	39.12	3 26
	C	97.98	—	—
5	A	43.26	40.99	2.27
	B	43.33	42.37	0.96
	C	99.81	96.73	3.08

A = % yield of fillets based on wt. of fish caught.
B = % yield of fillets based on wt. of fish landed.
C = % yield of landed round fish based on wt. of fish caught.

is likely to have a higher percentage of grade one fish than penned fish. Besides providing some improvement in quality at landing, as shown here and as reported by Waterman (1964), boxing permits the catch to be carefully and speedily handled during and after discharge from the vessel with consequent maintenance of quality till delivered to the consumer.

REFERENCES

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