C H A P T E R - 4

STUDIES ON THE EXTRACTION OF WATER AND PRODUCTION OF TOTAL VOLATILE NITROGEN IN PAMPUS ARGENTEUS (EUPHRASEN) FISH MUSCLES DURING PRESERVATION IN SALT

INTRODUCTION

Silver pomfret (Pampus argenteus) is economically important, highly prized marine fish. In recent years improved landing has been recorded in Gujarat (Jhingran, 1983). Part of the catch is dry salted. Heavily salted fish can be preserved over a longer period but it develops a strong salty taste whereas lightly salted fish develops a cured flavour but has shorter storage period because low concentration of salt cannot withdraw sufficient amount of water from the tissue of fish.

Various physical and biochemical processes are associated with changes in various constituents of the fish due to penetration of salt into tissues (Voskresensky, 1958). Salt retards bacterial and enzymatic spoilage (Kreuzer, 1972). However, the quantity of salt to be used for preserving perishable commodities such as fish is often limited by consumer acceptability.

When used in sufficient quantity, common salt preserves the fish by extracting the water from fish tissues and penetrating into the tissue.

For improving the present status of salting process to preserve the commercially important food fishes, present experiment was undertaken to find out effect of varied salt concentration on some aspects of quality of silver pomfret stored at room temperature.

MATERIAL & METHODS

Silver pomfret (Pampus argenteus) were obtained from market. The average size was 6 cm in length. As judged by organoleptic and visual test, these fishes were in fresh condition Viscera was removed and fish was washed to remove adhered blood, mucous, etc.

Fishes slices were mixed with salt (wt/wt) in definite proportion and were kept in glass container and stored at room temperatures (± 30°C). Samples were divided into following batches :

Batch-1 : Fish and salt ratio 1:1
Batch-2 : Fish and salt ratio 1:3
Batch-3 : Fish and salt ratio 1:6
Batch-4 : Fish and salt ratio 1:9

About two fishes were taken from each batch after different intervals of time, 1, 3, 6, 9, 12, 15, 18, 21, 24 and 27 days.

SALT DETERMINATION

Fish slices were removed from salt and were quickly rinsed under tap water to remove the surface salt for about 10 sec. Sample was macerated thoroughly in the glass mortar. About 5 gms. of samples was accurately weighed and salt was extracted with redistilled water in a conical flask by occasional shaking and keeping it overnight at 0°C. The content was then made into volume and filtered using Whatman-1 paper. Salt content in the filterate was determined, using titration method, against standard silvernitrate solution (Mohr, 1959). The salt content value was expressed (gm/100 gm of fresh fish) on dry weight basis.

MOISTURE CONTENT

Moisture content was determined by drying the samples at 100 to 105°C temperatures until the constant weight was reached (AOAC, 1960) and was expressed on wet weight basis.

TOTAL VOLATILE NITROGEN (TVN)

PREPARATION OF EXTRACT

The extract was prepared by mixing 2 gm of minced sample with 25 ml of 5% TCA in a glass mortar. After

20 min. the extract was filtered using Whatman-1 filter paper. Filterate was stored at 0°C temperature.

Conway micro diffusion techniques of Conway and Byrne (1933) modified by Pearson (1962) was used to determine the TVN values. In this method boric acid solution was used instead of standard acid in the central compartment of Conway dish and it was titrated against N/70 H_2SO_4 solution.

STATISTICAL METHOD

The statistical regression analyses was carried out (Mian and Miyan, 1984).

RESULTS & DISCUSSION

SALT CONTENT

It was found that with the increase of concentration of salt the uptake of salt also increased. The highest content of salt of fish muscle was found in batch-4 (32.68% in 27 days of storage). The lowest salt content (20.76% in 27 days) was found in batch-1. In the remaining batches 2 and 3, the highest salt content were 22.66% and 26.19% in 27 days of storage under similar storage conditions. From the first day salt content and the rate of uptake of salt showed gradual increase.

Batch-1 : Fish-salt ratio 1:1 by weight

Storage days	Salt content (%)	Moisture (%)	TVN mg.N/100 gm of fish flesh
1	6.0	76.20	12.47
3	10.13	67.87	14.66
6	12.88	66.12	17.53
9	14.15	65.00	19.92
12	15.38	60.70	23.25
15	17.16	59.84	29.66
18	18.00	58.00	31.95
21	19.25	54.74	35.63
24	18.79	54.40	37.50
27	20.76	53.25	43.16

Table-1 : Changes in salt-moisture and TVN content at 1:1 fish-salt ratio

All of the four batches showed almost similar trend (Tables 1 to 4). Salt content increased in the later stage of storage. The cause of this has been explained by Minder (1952). According to him at a later stage of salting the muscle of fish swells and this swelling induces the movement of water from brine into the fish. It has also been observed that under the condition of the experiments salt content in the fish muscles increased with both the increase in the concentrations of salt and the length of period of storage. The results are in agreement with the findings of Berezen (1948), who reported that salt uptake in the fish muscles was dependent on the concentrations of salt in the dipping medium for the given period of storage. In different salt proportion samples, the salt content were different and uptake was continued upto 27 days of storage. In case of Batch-4 the salt contents reached at a level of 32.68% in 27 days, which is higher than the other batches. The quality of product depends on the salt uptake by the fish muscle. Salt arrests bacterial contamination and growth. It also retards autolysis due to enzymatic action (Kreuzer, 1972) thus prolonging shelf-life.

The relationship between salt and moisture; moisture and TVN; TVN and salt contents with storage period in days are shown in figures 15, 14 and 13.

Batch-4 : Fish-salt ratio 1:9 by weight

Storage days	Salt contents (%)	Moisture contents (%)	TVN mg.N/100 gm of fish flesh
1	7.38	73.62	11.76
3	9.64	71.73	11.76
6	13.53	68.37	14.47
9	19.37	60.78	16.55
12	22.74	57.52	18.16
15	21.78	54.37	19.42
18	24.71	53.39	21.69
21	25.14	47.78	23.28
24	28.86	45.25	25.36
27	32.68	42.77	26.13

Table-4 : Changes in salt, moisture & TVN contents at 1:9 fish-salt ratio

MOISTURE CONTENT

The moisture content of salted fish with different salt concentration is presented in tables 1 to 4. Moisture level dropped upto a level of 53.25%; 49.35%; 47.81% and 42.77% in 27 days of storage respectively. The highestmoisture contents of 53.25% was found in batch-1 (Table-1) and lowest moisture contents 42.77% was found in batch-4 (Table-4) in 27 days of storage. Anderson and Pederson (1951) reported that moisture contents of the salted fish products varied from 20-25% on wet weight basis and depended on the concentration of salt within the fish flesh. Voskresensky (1958) reported that the transfer of water depended on the intake of salt. The change in weight depends on salt concentration. Fish muscle contain 30-35% bound water (Levanidov, 1954). When the fish muscle receives 15-20% salt concentration the bound water is changed to free state. In batch-4 the water loss was much more than the other batches. The loss of water depends on salt uptake (Table-4). The product becomes hard as water is lost due to osmosis during salting (Voskresensky, 1958).

TVN VALUES

The TVN values increased from 12.47 to 43.16; 11.39 to 36.54; 9.47 to 29.61 and 11.76 to 26.12

Batch-2 : Fish-salt ratio 1:3 by weight

Storage days	Salt content (%)	Moisture (%)	TVN mg.N/100 gm of fish flesh
1	7.63	75.37	11.39
3	9.00	72.51	13.48
6	13.46	68.63	15.72
9	16.27	64.57	14.39
12	18.50	66.50	16.44
15	19.63	65.73	18.74
18	18.92	64.39	21.72
21	20.38	61.21	24.58
24	21.87	52.62	29.32
27	22.66	49.35	36.54

Table-2 : Changes in salt, moisture & TVN contents at 1:3 fish-salt ratio.

mg.N/100 gm of fish flesh in 1 to 27 days of storage in batch - 1 to 4 respectively (Tables 1 to 4). The samples were unacceptable for consumption when TVN values exceeded on 30 mg.N/100 gm of fish flesh. Fish samples were acceptable upto 18 days in batch-1, where the TVN value was found to be 31.95 mg.N/100 gm of fish muscles. In batch-2, samples were acceptable upto 24 days of storage, The TVN values was found to be 29.32 mg.N/100 gm of fish flesh. Samples from batch 3 & 4 were acceptable throughout the study which was extended upto 27 days. Cutting and Waterman (1965) reported that common salt when in sufficient strength, preserve the fish by extracting the water from the fish tissue. The exchange of nitrogenous substances caused the decreases in weight of the fish tissues during salting (Alm, 1956). Ivanova (1958) indicated that some nitrogenous substances diffuse from the fish into the salt during salting. The TVN values considerably increased during the salting storage, particularly in batch-1. The slower rate of spoilage was perhaps due to the retardation of enzymatic action by the action of salt. Many workers reported that TVN values 30 mg.N/100 gm of fish flesh should be taken as the upper limit of acceptability (Shewan, 1938; Ota, 1958). Tanikawa (1935) also found that the volatile basic nitrogen content was useful as a measure of spoilage and suggested 30 mg.N/100 gm as the upper limit of acceptability. Tanikawa and Akiba (1955)

Batch-3 : Fish-salt ratio 1:6 by weight

Storage days	Salt contents (%)	Moisture (%)	TVN mg.N/100 gm of fish flesh
1	12.63	75.37	9.47
3	15.25	68.75	12.96
6	16.88	66.28	13.86
9	17.69	61.28	14.23
12	17.98	60.18	14.91
15	18.46	54.34	16.39
18	18.94	52.75	17.72
21	19.23	50.87	19.34
24	24.68	48.32	23.60
27	26. 9	47.81	29.61

Table-3 : Changes in salt, moisture & TVN contents at 1:6 fish-salt ratio

LIST OF FIGURES

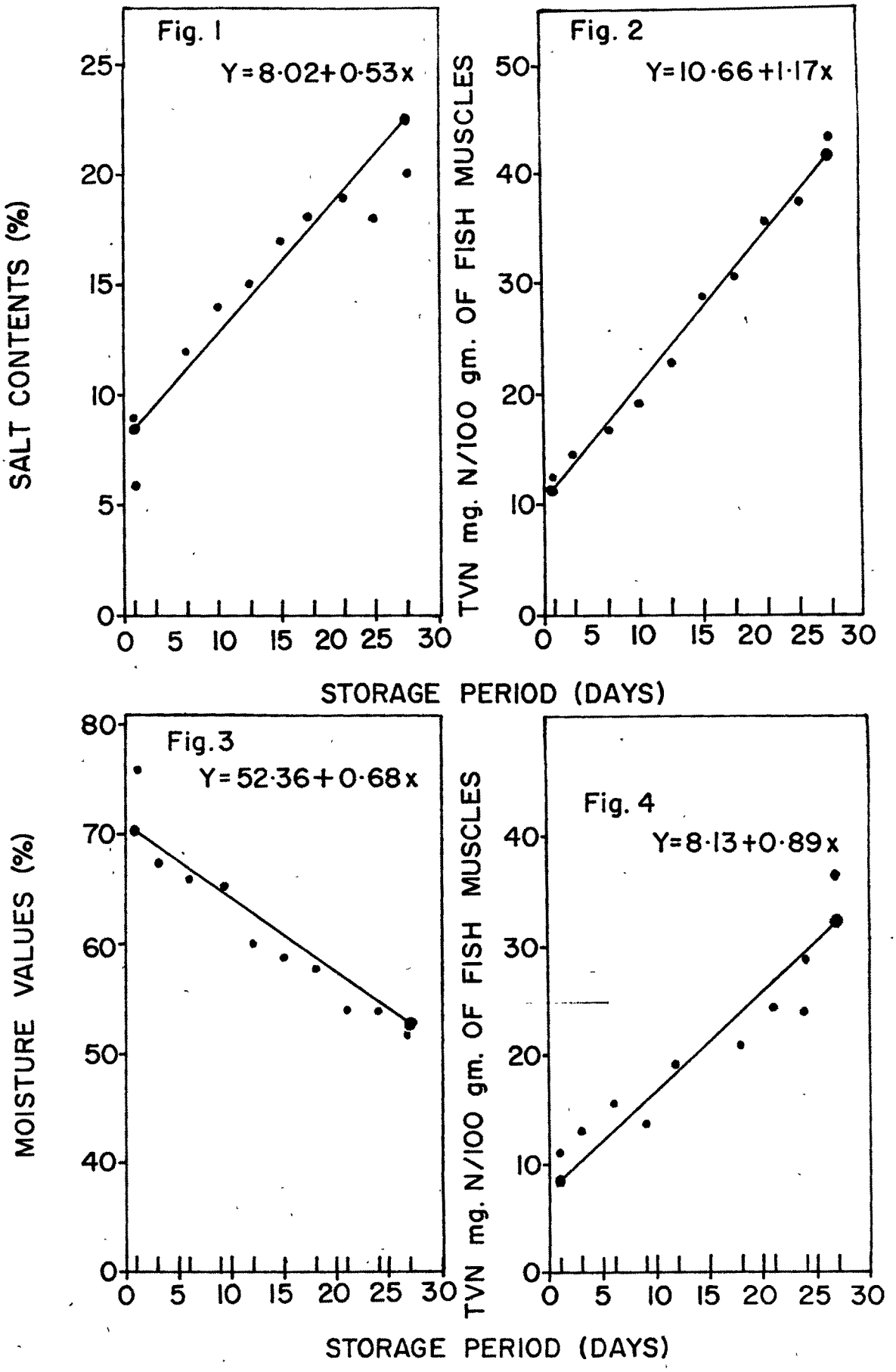
Fig. 1
Y=8·02+0·53x
SALT CONTENTS (%)
Fig. 2
Y=10·66+1·17x
TVN mg. N/100 gm. OF FISH MUSCLES
STORAGE PERIOD (DAYS)
Fig.3
Y=52·36+0·68x
MOISTURE VALUES (%)
Fig. 4
Y=8·13+0·89x
TVN mg. N/100 gm. OF FISH MUSCLES
STORAGE PERIOD (DAYS)

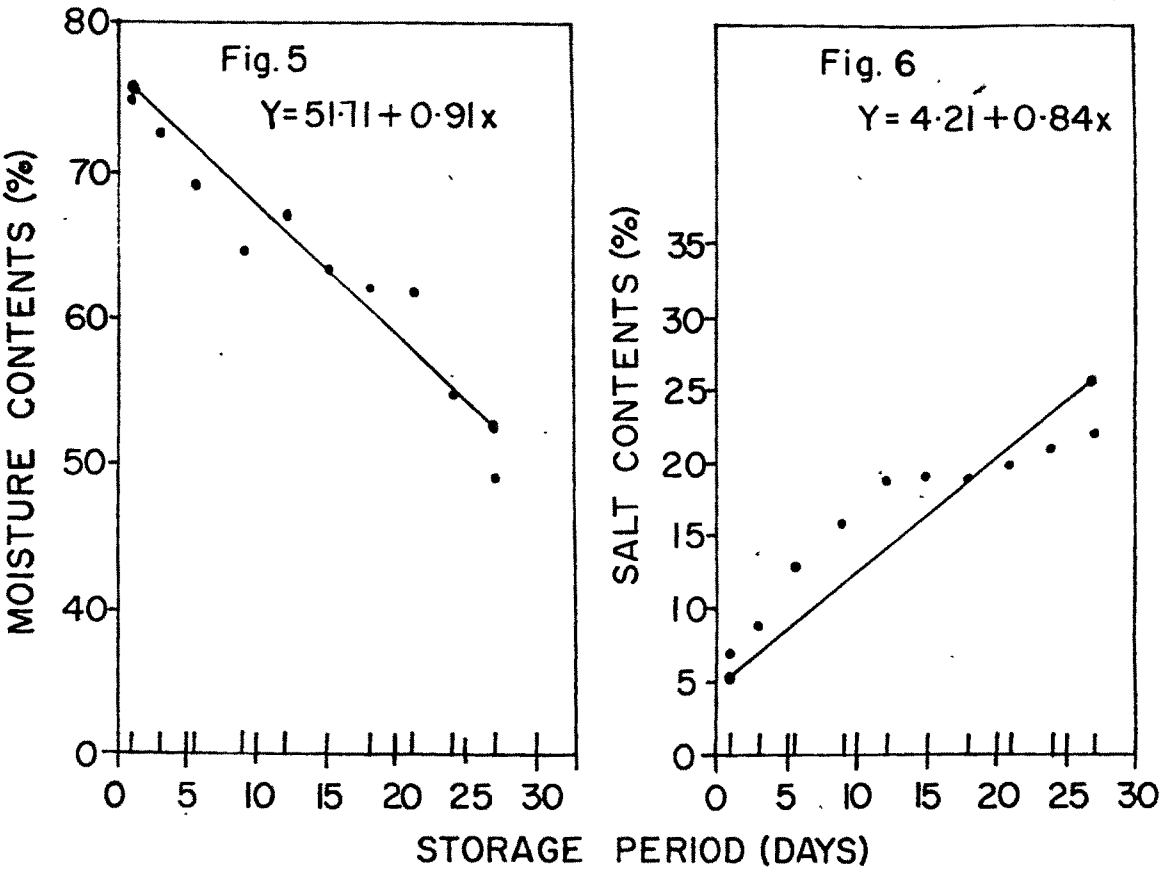
Fig. 5
Y=51·71+0·91x
MOISTURE CONTENTS (%)
Fig. 6
Y=4·21+0·84x
SALT CONTENTS (%)
STORAGE PERIOD (DAYS)

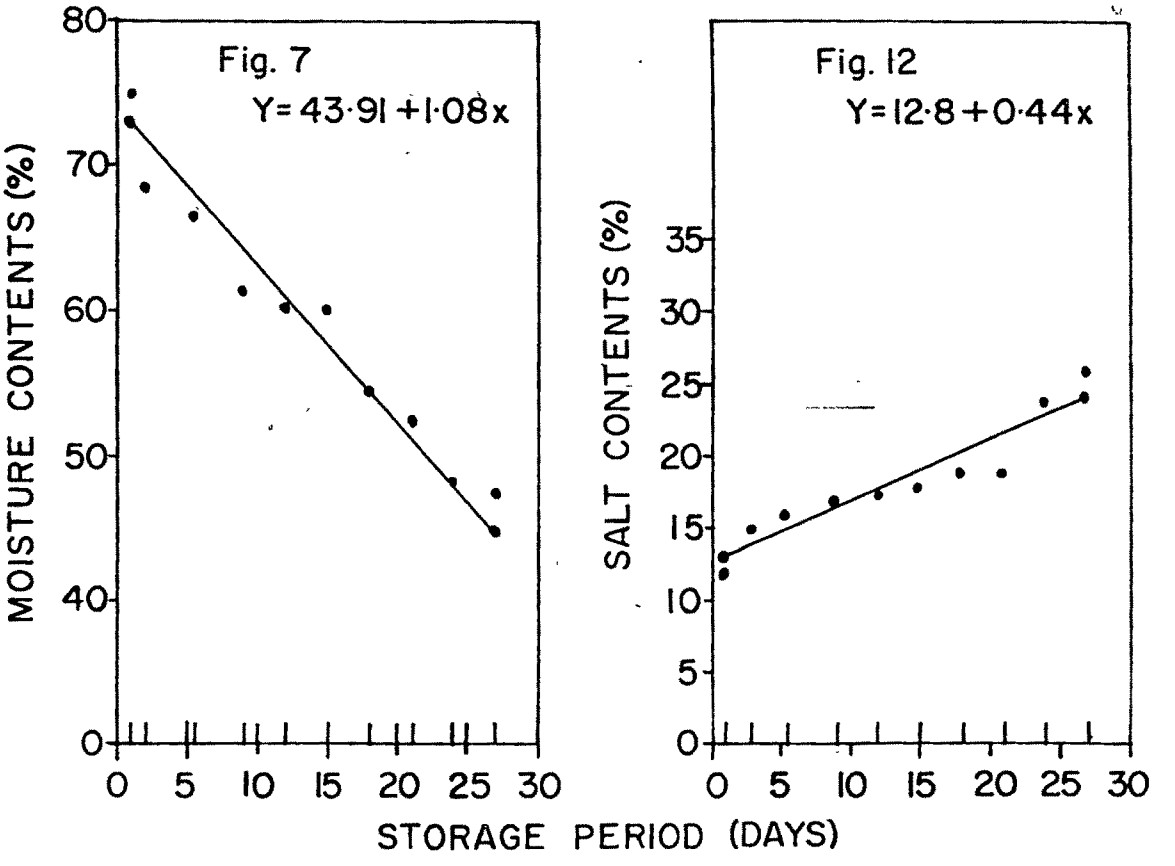
Fig. 7
Y=43·91+1·08x
MOISTURE CONTENTS (%)
Fig. 12
Y=12·8+0·44x
SALT CONTENTS (%)
STORAGE PERIOD (DAYS)

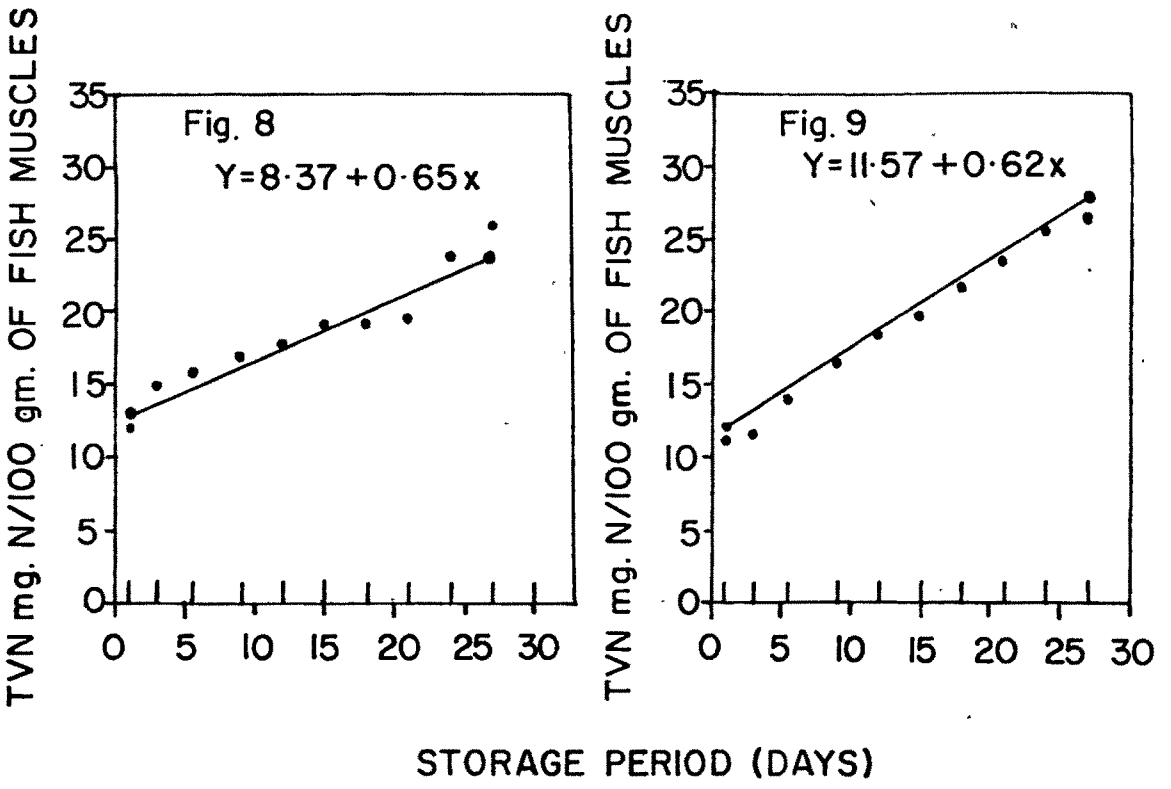
Fig. 8
Y=8·37+0·65x
TVN mg. N/100 gm. OF FISH MUSCLES
0 5 10 15 20 25 30 35
0 5 10 15 20 25 30
Fig. 9
Y=11·57+0·62x
TVN mg. N/100 gm. OF FISH MUSCLES
0 5 10 15 20 25 30 35
0 5 10 15 20 25 30
STORAGE PERIOD (DAYS)

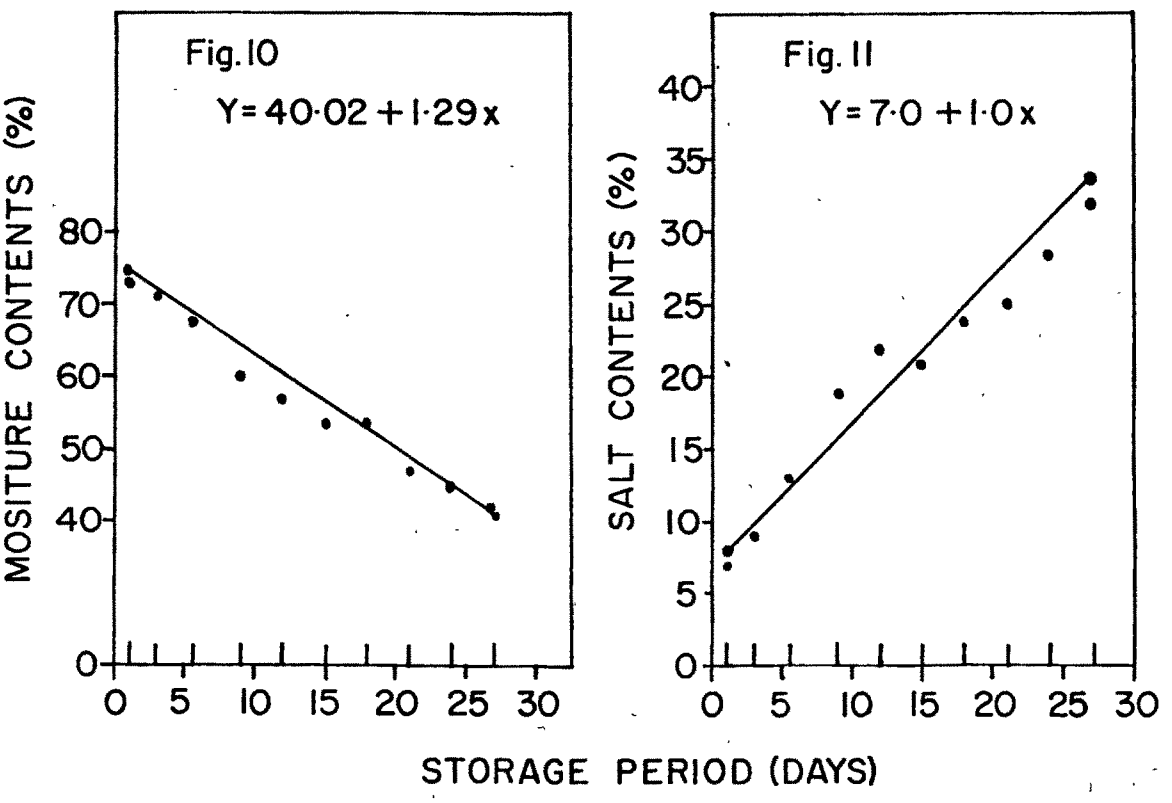
Fig.10
Y=40·02+1·29x
MOSITURE CONTENTS (%)
0 40 50 60 70 80
0 5 10 15 20 25 30
Fig. 11
Y=7·0+1·0x
SALT CONTENTS (%)
0 5 10 15 20 25 30 35 40
0 5 10 15 20 25 30
STORAGE PERIOD (DAYS)

suggested 20 mg volatile basic nitrogen/100 gm as the upper limit for fresh fish. So, a limitation line could be drawn at the TVN values below 30 mg.N/100 gm fish muscle for acceptable limit in case of salted pomfret stored at room temperature. The relationship between salt content, moisture content, TVN values during storage were plotted and the results are compared by plotting regression lines (Figs. 1 to 12).

On the basis of the results obtained we may conclude as follows : The effects of salting arrest the volatile nitrogen formation. Salting retards the spoilage and prolong the shelf-life resulting in better quality product. Heavily salted fish showed some discolouration and becomes hard. Less salted product were unacceptable after few days due to spoilage. If salting of the fish is carried out scientifically, under hygienic conditions, using fish salt ratio 1:3 or 1:6 the product turns out to be better in quality in all respect. On prolonged storage of dry salted fish, it shows weight loss which is unprofitable from the commercial standpoint.

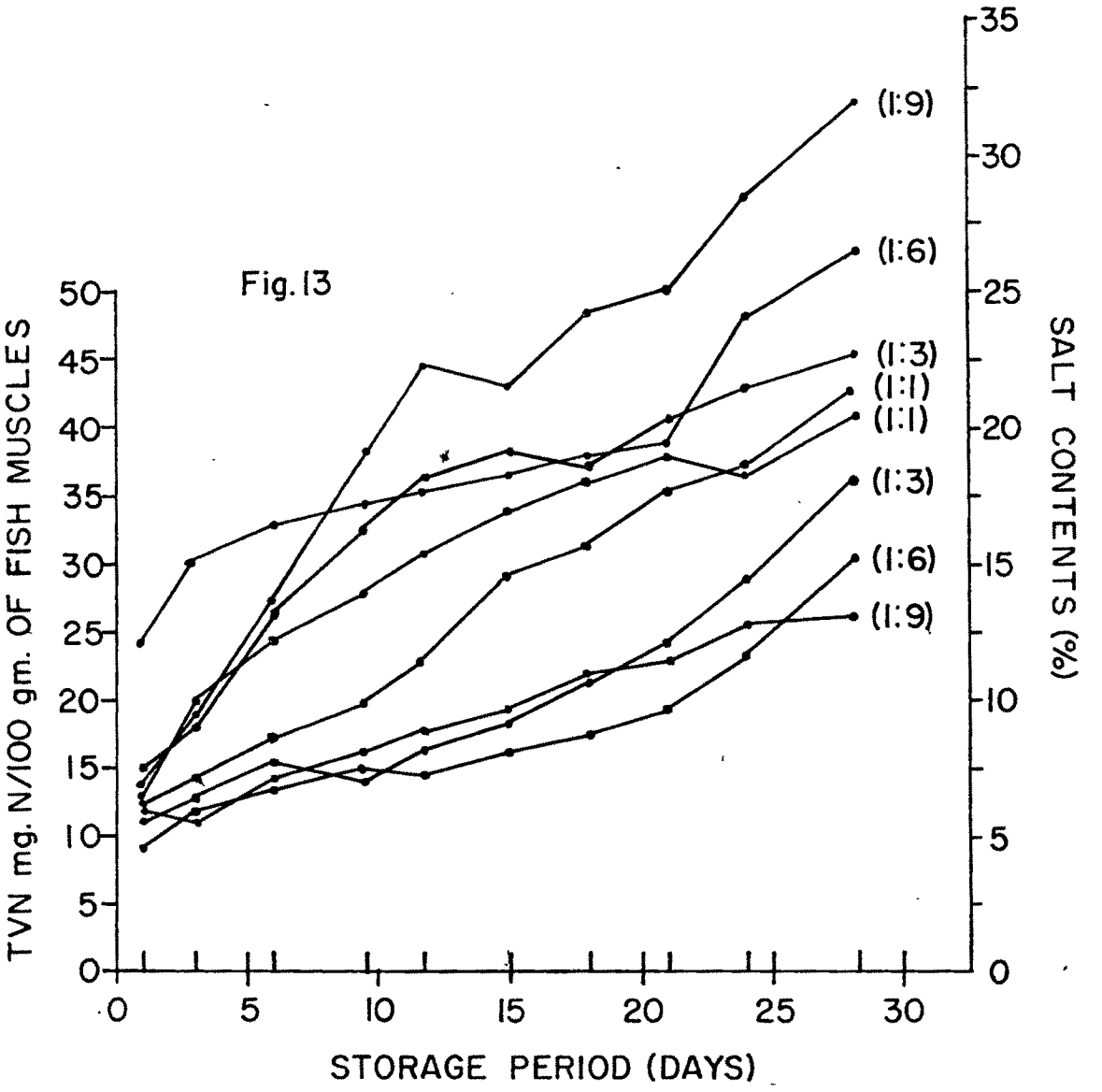
Fig. 13
TVN mg. N/100 gm. OF FISH MUSCLES
SALT CONTENTS (%)
STORAGE PERIOD (DAYS)
(1:9)
(1:6)
(1:3)
(1:1)
(1:1)
(1:3)
(1:6)
(1:9)
0
5
10
15
20
25
30
35
40
45
50

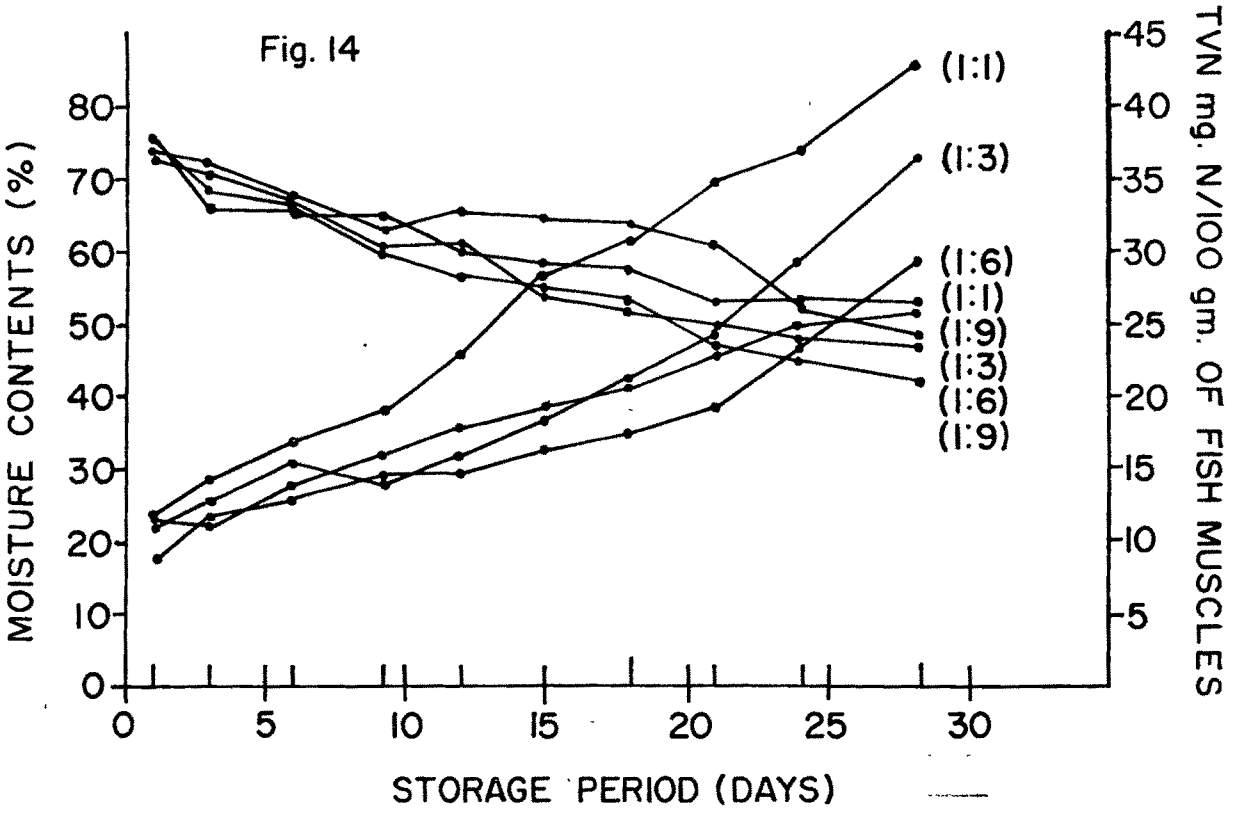
Fig. 14
MOISTURE CONTENTS (%)
TVN mg. N/100 gm. OF FISH MUSCLES
STORAGE PERIOD (DAYS)
(1:1)
(1:3)
(1:6)
(1:1)
(1:9)
(1:3)
(1:6)
(1:9)
0
10
20
30
40
50
60
70
80
5
10
15
20
25
30
35
40
45

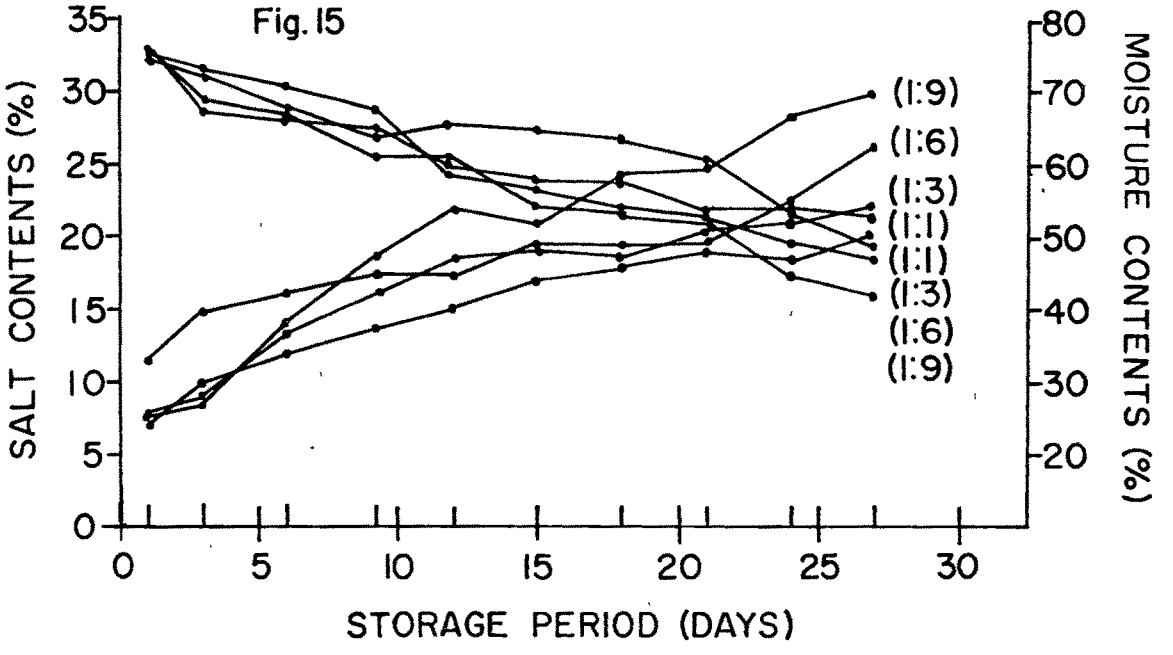
Fig. 15
SALT CONTENTS (%)
MOISTURE CONTENTS (%)
STORAGE PERIOD (DAYS)
(1:9)
(1:6)
(1:3)
(1:1)
(1:1)
(1:3)
(1:6)
(1:9)
0
5
10
15
20
25
30
35
40
50
60
70
80