SEASONAL VARIATION IN THE CHEMICAL COMPOSITION OF POMFRETS - I BLACK POMFRET (PARASTROMATEUS NIGER)

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Seasonal variations in proximate composition of the different parts such as head, middle, tail and skin of black pomfret (Parastromateus niger) are reported over three years on monthly basis. The lean and fatty conditions of fish are discussed on the basis of spawning period, food and feeding activity, size group appearance and the gonadial maturity of the pomfret.

INTRODUCTION

The pomfrets, black (Parastromateus niger) and silver (Pampus argenteus) rank first among the important species of available fish in India. About 18,000 tonnes of pomfrets (black, silver and white) are landed every year, constituting 2 to 3 percent of the total fish catches in India. Black pomfret is one of the most important fishes of commercial value on Gujerat and Maharashtra coasts.

Much has been written on seasonal variations in the proximate composition of various species of fish particularly those used for human consumption and whose oil content is valued commercially. Seasonal changes in the proximate composition of fish have been attributed to (1) difference in the amount of food or the type of food available or both (Venkataraman and Chari, 1953; Stansby, 1963), (2) feeding habits of the species in relation to the reproductive cycle (Chidambaram, *et al* 1952), (3) size and maturity of the fish (Chidambaram *et al, loc, cit.* Flood, 1958; Mary Thompson, 1966), (4) geographic location of catch (Venkataraman and Chari, 1951), (5) reproductive cycle of the species (Hart *et al*, 1940, Venkataraman and Chari, 1951, Donald, 1966 and many others) and (6) sex (Chidambaram *et al, loc cit.*)

The above and some other factors such as temperature, hours of light etc. have also been reviewed recently by Mary Thompson *(loc, cit.)*

At Veraval, black pomfret appears in large shoals in March, April and May.

No detailed data concerning the seasonal variations and approximate compo-

sition of pomfrets are found in the Indian literature. Yet, a knowledge of the proximate composition and its possible seasonal variation would be of value to any one using this resource or contemplating its use.

This paper reports the proximate composition of black pomfret with emphasis on variations to be expected throughout a single year and also from year to year in different parts of the fish such as head, middle, tail and skin and also considers possible causes of any seasonal variation found in the proximate composition.

Materials and methods

Every month two or three absolutely fresh black pomfrets selected at random, were procured either from the landing centre or from the market. Only mature samples, whose weight exceeded 550 gms were selected for the study.

Prior to analysis individual fish was weighed nearest to the gram and measured to the nearest millimeter. As this species is having the "fork-tail", the length was measured from the tip of the mouth to the apex of the angle formed by the two sides of the tail-fins. The scales were removed and different parts such as head, middle, tail and skin (as shown in Figure I) of the body were separated followed by chemical analysis for moisture, fat, protein, salt (as NaCl) and ash content by the methods of AOAC (1960).

Results and discussion

Figures 2, 3 and 4 show the seasonal variation in percentage composition of moisture and fat contents of black pomfret for two consecutive seasons. Figure 2 represents the average value of all the four parts viz; head, middle, tail and skin portions, which were analysed individually.

Figure 2 reveals that maximum fat and minimum moisture contents in black pomfret are in the mohth of April, while minimum fat and maximum moisture contents are noted in July, August, September and October. Also the negative correlation between fat and moisture contents is quite distinct in figures 2, 3 and 4.

Seasonal variations in fat.

Hornell and Ramaswami Naidu (1924) studying the life history of the Indian sardine, found that the variation in lipid content can be attributed to the presence or absence of two classes of plankton, the *dinoflagellates* and *copepods*. The growth of oysters (Kravic 1953) and mussel (Fraga, 1956) varies with the quantity of available plankton. All these observations indicate that the fat variation in fish depends upon the quantity of the available fat in the diet and the feeding activity of fish. The latter has been confirmed by Venkataraman and Chari (1951) and Chidambaram *et al* (1952).

In the case of black pomfret also the same role of food and feeding activity on the fat variation has to be considered. Black pomfret is a carnivore (C. M. F. R. I. Reports, 1962, 1963) and mostly feeds on *Salpids, Amphipods, Doliolids, young prawns, Crustacean, Larval Polychaetes, Stomatopods* etc. Hence fat variations in black pomfret need not correlate with the availability of the plankton unlike plankton feeders like mackerel or sardine.

From Figures 2, 3 and 4 it is observed that in November and in March, April and May the fat content is maximum for different seasons.

In March, April and May the percentage of fat is at its peak. The possible reasons of this higher value are discussed below.

(1) The first and plausible reason may be the high intensity of feeding activity of the fish. Wimpenny (1938) has reported that the accumulation of fat owes its origin to the food previously eaten by the fish. Working on herring, Lovern and Wood (1937) found them in a lean condition in winter, and with food becoming abundant in April and the two following months they feed heavily, resulting in the storage of fat. Similar observation was also made by Sekharan (1949), when working on the fat variations in muscles of the rain-bow sardine *(Dussumieria acuta)* on the Madras Coast. He has reported a maximum fat content in October with small rise in April-May and indicated the possible cause for the rise and fall and due to the feeding activity and especially the inclusion of teleosts in its diet.

As seen before, black pomfret consumes various fish and shell-fish which are in abundant quantity, as indicated by its abundant catch during the period from January to June. (Annual Reports, C. M. F. R. I., from 1961 to 1966). As a result the fish is gaining more fat during this period.

(2) Another possible cause for the rise in fat content may be the advancing condition of development of gonads, prior to the spawning period. This is one of the most accepted reasons for higher value of fat content of the fish all over the world. Milroy (1906, 1908) has reported a rapid rise in the percentage of fat in the mnscles during the several months prior to the time when rapid growth of ovaries and testes began. Channon and Saby (1932), in the case of herring indicated a rise in the fat content of muscle before spawning, followed by a fall after spawning. In the case of Scottish herring, Lovern and Wood (1937) observed a similar trend of variation in fat content before and after spawning. Similar findings were also made by Wilson (1939), Sekharan (1949), Chidambaram *et al* (1952) and Mary Thompson (1966).

The greater accumulation of fat during this period is naturally explained as the reserved energy required for the spawning activity in the months to follow when feeding activity may be restricted (Chidambaram *et al* 1952).

(3) The fatty condition may also be atttributed to the appearance of bigger size groups. The major fatty condition of black pomfret is observed in the months of March, April and May when the catches comprise of biggest dominating size-groups, (34.0—36.0 cms) (Table I).

In the case of mackerel, Chidambaram *et al* (1952) stated that the feeding activity of the larger sized mackerel is very intense in April, coinciding with the minor peak of production of plankton. This statement confims two of the three aforesaid reasons given for the major fatty condition of the fish.

(4) The rise in fat may also partly be considered as the effect of the season itself. The rise in fat of black pomfret coincides with the on-set of summer.

The minor peak of fat that appeared in November may have resulted from higher feeding activity of the fish after the spawning fast.

The extreme low fatty condition observed in July, August, September and October coincides with the spawning period which is believed to be from June to October (C. M. F. R. I. Annual Reports 1962, 1963, 1964). This observation coincides with the views of several authors like Channon and Saby, (1932); Lovern and Wood, (1939); Venkataraman and Chari

(1951); Chidambaram *et al* (1952); Arevalo (1949); Donald, (1966); Mary Thompson, (1966) etc.

The lower fatty condition of the fish during its spawning period may be explained as due to the poor feeding activity during this period. As quoted by by Chidambaram *et al* (1952) there have been references relating to the amount of fat during the migration of *Scomber-Scombrus* by Stansby and Lemon (1941) wherein they suggest that the fish may not feed during their long distance migration for spawning.

VARIATION IN SIZE

The survey of the random samples of black pomfret drawn during different months from the commercial catches (C. M. F. R. I. Annual Reports 1961, 1962, 1963 and 1964) indicated the variations in size group appearance as given in Table I. It is evident from this table that fish of the size 26–41 cms. are common throughout the year with different dominating groups. The major dominating group is from 28.0 to 32.0 cms. The juveniles of the size 4–14 cms met with during November, December, January and February are note-worthy as it helps in deciding the probable spawning period.

SEASONAL VARIATIONS IN PROXIMATE COMPOSITION OF HEAD, MIDDLE, TAIL AND SKIN REGIONS OF BLACK POMFRET

Figures 3 and 4 give the distinct seasonal variations in moisture and fat contents of head, middle, tail and skin regions, for the years 1965–66 and 1966-67. As expected, the fat and moisture contents of the skin exhibit the greatest variation throughout the season. Next to that is the head region which also shows considerable variation in fat and moisture contents The middle and tail parts of black pomfret show the least variation throughout both the seasons. These results throw light on an important observation that the skin and head portions of black pomfret are very much susceptible to the seasonal effects and undergo vast variations in fat and moisture contents. This itself suggests, that whenever the seasonal variation in fat of fish is studied. not only the body muscle but other parts also should be considered.

In the course of this study the contents of fat and moisture bear an inverse relationship except in the case of one or two months. Many authors who have worked on seasonal variation in fat and moisture contents in fish have also observed the same pattern. (Brandes, 1954; Jacquot and Creach, 1950; Power, 1964; Donald, 1966; Mary Thompson, 1966 and many others.)

The moisture and fat contents of middle and tail parts of black pomfret do not differ significantly (Fig. 3 and 4).

The protein, ash and salt (as NaCl) were also analysed systematically along with moisture and fat. But as they do not give any plausible correlation with various seasons, the figures are not given for the same. The protein content in different parts except skin of black promfret does not vary significantly.

Table II provides an interesting comparison of the average values of moisture and fat of the head, middle, tail and skin portions of the black pomfret for two individual seasons (i. e. 1965–66 and 1966–67). No significant difference is noted between average values of the composition for two seasons for various parts of the fish except in the case of skin. Moreover the sum of percentage of the moisture and fat contents of all the four parts of the same fish has remained constant in the next season with a negligible difference.

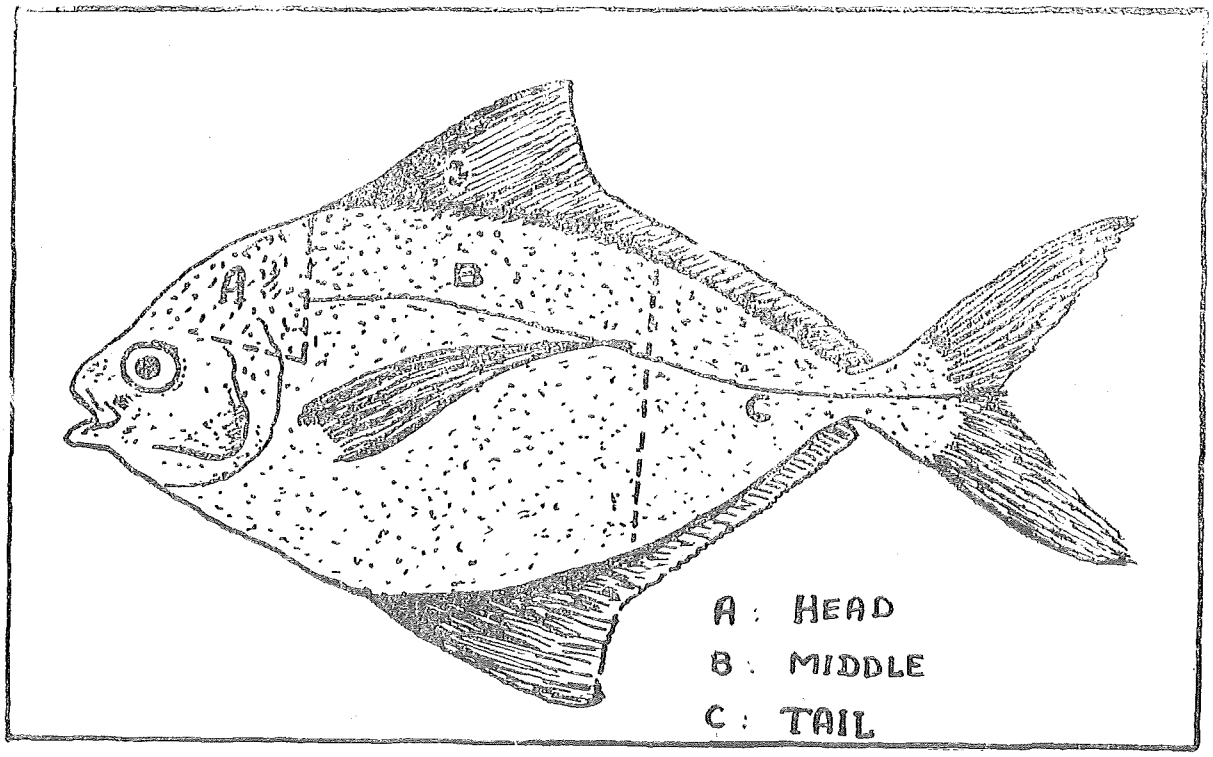

Fig. 1. Black Pomfret

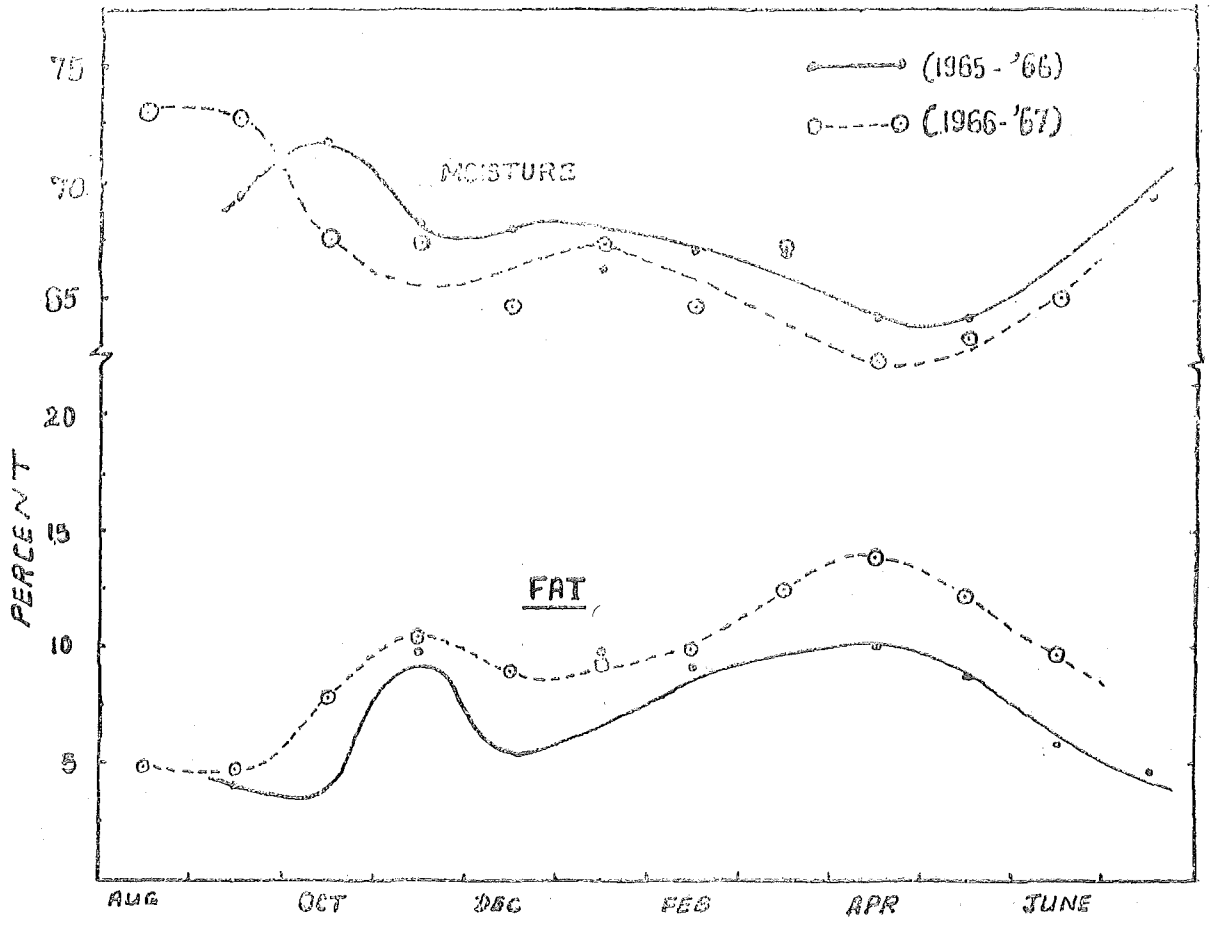

Fig. 2 Seasonal variation in Moisture and Fat contents of Black Pomfret. (Average value of Head, Middle, Tail and skin portions)

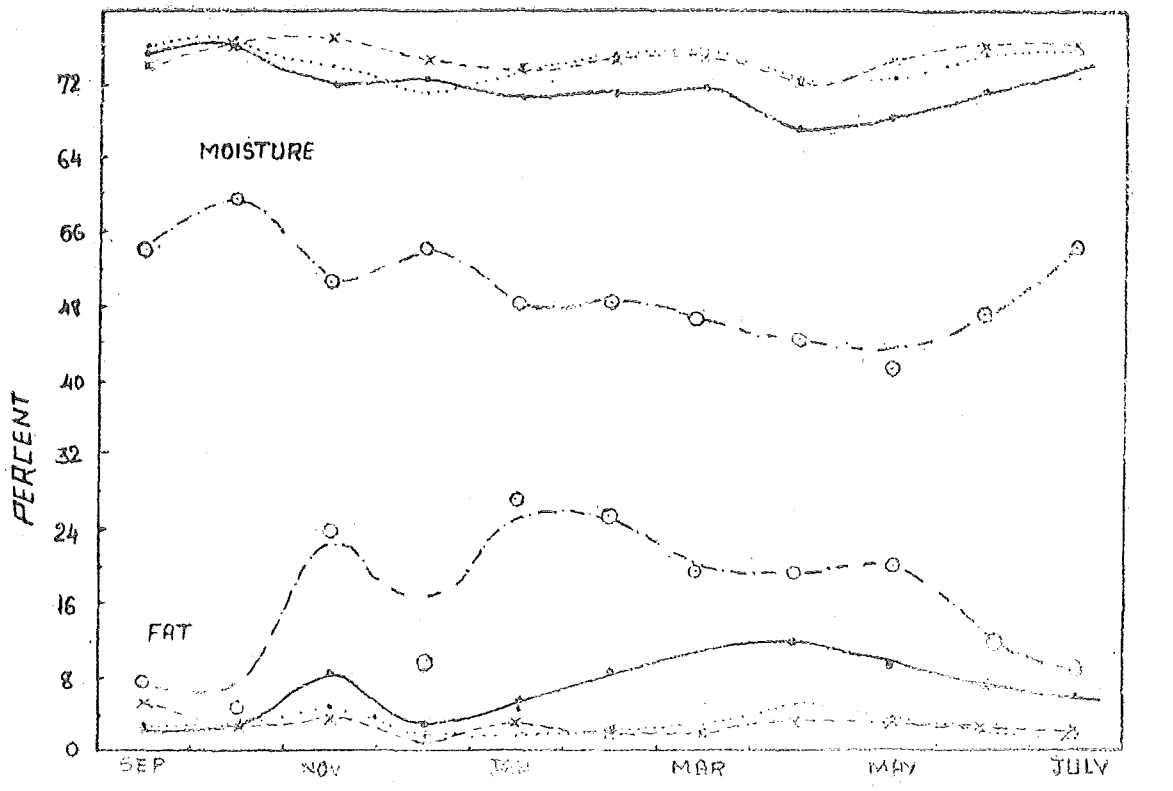

Fig. 3 Seasonal variation in Moisture and Fat contents of Head, Middle, Tail and Skin parts of Black Pomfret (1965-1966)

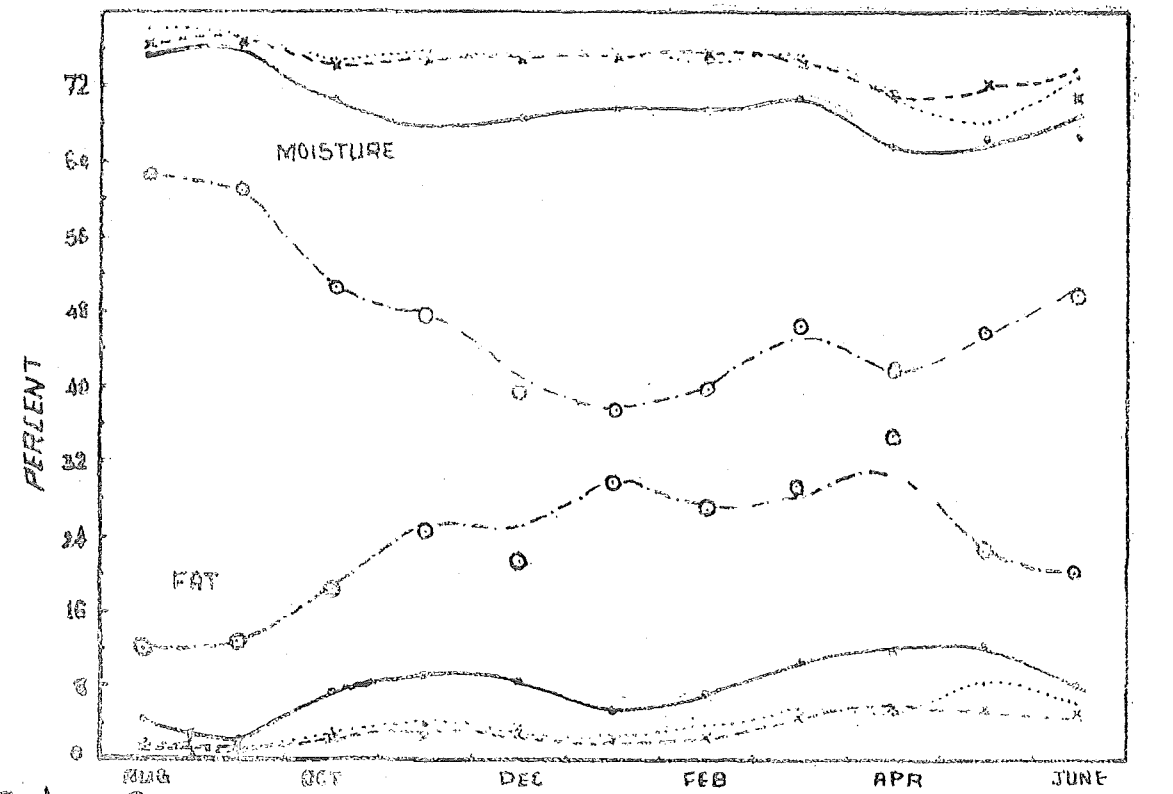

Fig 4 Seasonal variation in Moisture and Fat content of Head, Middle, Tail and Skin parts of Black Pomfret (1966-1967)

TABLE I SIZE GROUP APPEARANCE OF BLACK POMFRET

Month	Year	Size group appearance cm	Dominating size group cm
September	1961	22.0 — 48 0	28.0 — 30.0
October	1961	18.0 — 48.0	26.0 — 28.0
November	1961	23.0 — 41.0	30.0 — 32.0
November last week	1961	10.0 — 14.0	Juveniles
December	1961	4.0 — 47.0	28.0 — 30.0 & Juveniles
January & February	1962	26.0 — 41.0	26.0 — 41.0
March, April & May	1962	22.0 — 46.0	34.0 — 36.0
August to October	1962	18.0 — 48.0	26.0 — 30.0
September & October	1963	17.9 — 44.3	...
January & February	1964	(6.8 — 14.6) Juveniles	...

RELATION BETWEEN SIZE AND PROXIMATE COMPOSITION OF BLACK POMFRET

The various pairs of figures in Table III represent the proximate composition of black pomfret in relation to identical size (length) of fish caught during the same and also in different periods.

The fish of the same size that appeared in the same month and year does not differ significantly in its composition, with respect to their different weights. (Pairs 1,2 and 3).

The pairs 4, 5 and 6 represent the fish of the same size group but caught in different months of the same year. Significant difference is observed in their weight, moisture, fat and protein contents. These are the graphic examples of the seasonal variations in the composition of the fish.

Further the fish having about the same size, caught in the same month but in the different calender year does not have have exactly the same percentage composition of moisture, protein and fat.

This variation may be attributed to two possible reasons: (1) the difference in the amount of food or the type of food available, or to both the amount and the type and (2) the difference in geographic location of catch. (Venkataraman and Chari, 1951, 1953).

SUMMARY

Representative samples of black pomfret available at Veraval coast were analysed with the following results.

1) The various parts such as head, middle, tail and skin of the fish undergo seasonal variations in proximate composition in different levels. Skin and head parts are considered to be very much susceptible to the seasonal effects as they undergo the greatest seasonal variation in fat and moisture contents while middle and tail parts show the least variation.
2) Skin and head portions possess greater amounts of the total fat in the fish. The fat contents of middle and tail do not vary significantly.
3) Moisture and fat contents displayed a strong inverse relationship to each other.
4) The maximum fat content was observed in March, April and May which coincides with the pre-spawning period. A minor peak was also observed in November.
5) The lean condition of the fish coincides with the spawning period of black pompfret.

TABLE II AVERAGE VALUE OF MOISTURE AND FAT OF HEAD. MIDDLE, TAIL AND SKIN PARTS OF BLACK POMFRET FOR 1965—'66 AND 1966—'67.

Constituents		HEAD		MIDDLE		TAIL		SKIN	
		1965-'66	1966-'67	1965-'66	1966-'67	1965-66	1966-'67	1965-'66	1966-'67
MOISTURE	Percentage	71.72	70.12	74.42	73.81	74.77	74.45	49.86	46.10
	Range	67.3-76.0	65.97-76.27	70.98-76.05	68.15-78 08	72.1-76.7	71.0-77.5	41.13-59.6	37.58-62.4
FAT	Percentage	6.44	7.88	3.08	3.95	3.0	3.24	16.18	22.71
	Range	2.1-12.0	2.0-12.59	1.97-5.2	1.36-8.14	1.91-5.2	1.18-5.67	4.44-27.25	12.0-34.37
TOTAL PERCENTAGE		781.6	78.00	77.50	77.76	77.77	77.69	66.04	68.81

TABLE III COMPARISON OF PHYSICAL MEASUREMENTS AND PROXIMATE COMPOSITION OF BLACK POMFRET OF ABOUT THE SAME SIZE GROUP (FOR THE FLESH OF MIDDLE PART ONLY)

Pair No.	Date of catch	Length in cms.	Weight in gms.	Moisture %	Fat %	Protein %	Ash %
1	9—6—1964	42.5	1950	75.4	5.7	17.5	1.34
	15—6—1964	42.0	1770	75.5	5.7	17.3	1.37
2	22—6—1964	40 0	1585	75.6	5.5	17.5	1.28
	12—6—1964	40.0	1800	76.0	5.4	17.3	1.35
3	21—9—1966	36.2	1080	77.3	1.6	18.2	1.50
	21—9—1966	36.0	1050	78.0	1.5	17.8	1.43
4	16— 4—1964	35.0	955	74.8	2.6	20.1	1.74
	16—10—1964	35.0	895	76.9	3.2	18.5	1.77
5	1—11—1965	34 6	985	72.5	6.1	18.6	1.90
	17—12—1965	34.5	1200	71.0	2.0	20.3	1.82
6	12—4—1966	39.0	1525	74.3	4.4	18.3	1.21
	27—8—1966	39.0	1325	77.3	2.9	18 0	1.21
7	31—10—1964	30.0	810	75.4	4.2	18.2	1.64
	18—10—1965	30.0	1028	75.7	3.0	16.7	1.60
8	10—11—1964	34 0	614	76.4	4.0	18.4	1.45
	1—11—1965	34.6	985	72.5	6.1	18 6	1.90
9	18—5—1964	37.5	1020	73.6	3.8	20.9	1.75
	23—5—1967	37.6	1380	68.2	8.1	18.1	1.04
10	9—6—1964	42.5	1950	75.4	5.7	17.5	1.34
	7—6—1966	43.0	1960	75.2	2.4	18.4	1.62
11	17—12—1965	34.5	1200	71.0	2.0	20.3	1.82
	27—12—1966	34.0	835	75.1	3.1	20.0	1.52

6) No significant difference was noted in average value of the composition of various parts of the fish for two consecutive seasons under report.
7) Protein contents of head, middle and tail also do not differ much.
8) The fish of the same size appeared in the same month of the same year, did not vary significantly in its composition and the same size of fish showed variation in its composition if it was caught in the different months or different years.

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