

BIOLOGY AND BIOMETRY OF MILKFISH *CHANOS CHANOS* (FORSSKAL)

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ABSTRACT

Observations made on length-weight relationship for adult milkfish, ova-diameter frequency distribution, relationship between fecundity and total length, fecundity and standard length; and weight and fecundity are presented. The regression lines for 17 morphometric characters in relation to the standard length were worked out. Snout to anal origin grows faster than snout to ventral origin. Head length; shows faster rate of growth than head depth. The stomach content revealed the presence of diatoms predominantly. Fecundity varied between 1424 and 5321 thousands in the fish in the size range of 1,100 - 1,340 mm.

INTRODUCTION

ALTHOUGH the milkfish *Chanos chanos* (Forsskal), is one of the most important cultivable species of finfishes in various culture systems in Philippines, Indonesia, Taiwan, Hawaii, etc.

1951, 1952 and 1955), Chacko *et al.* (1953), Devanesan and Chidambaram (1953), Chacko and Mahadevan (1956), Tampi (1957), Panikkar *et al.* (1952) and Chacko and Thomas (1962) have recorded adult milkfish from Coromandal Coast, Palk Bay, Gulf of Mannar and

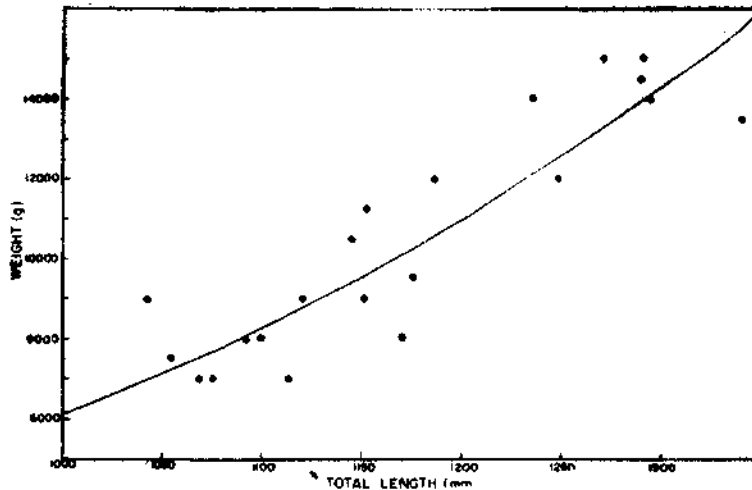


Fig. 1. Total length-weight relationship of milkfish.

catches of this species from the sea are negligible throughout the world. In India Chacko (1950,

Malabar Coasts. Valuable contributions have been made regarding several aspects of milkfish, such as spawning, occurrence of fry and fingerlings, food and feeding habits, etc. by Chacko (1945, 1955), Tampi (1957, 1958),

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Silas *et al.* (1980), Dorairaj *et al.* (1984), Mammen (1965), Mohapatra (1966) and Rangarajan and Ganapathy (1949). Tampi and Bensen (1976) have reviewed the work programmes on the biology of this fish carried out in India. Senta and Kumagai (1977) have studied the vertebral variation of the milkfish from various localities of the Indo-Pacific.

From these it may be seen that no work has been carried out on the biometry of adult

MATERIALS AND METHODS

Surveys have been conducted in Theedai and Ariyankundu in the Palk Bay, and Pudumadam and Appatheevu in the Gulf of Mannar areas to locate suitable centre for adult milkfish collection.

At Ariyankundu, bottom set nylon gill nets with a mesh size of 13 to 17 cm are being operated with the help of dugout canoes or small

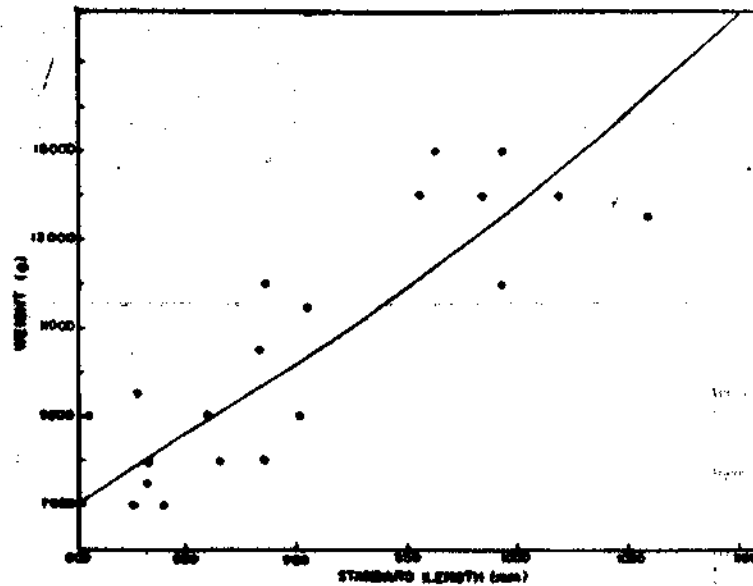


Fig. 2. Standard length-weight relationship of milkfish.

milkfish in India. Liao (1971) has given meristic and morphometric characters of nine adult specimens. In the present study, the authors have worked out the biometry, length-weight relationship and fecundity of milkfish.

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plank-built boats for catching adult milkfish. The sizes of the boats are 4 to 5 metres in length and 1.0 to 1.5 in width. Only one or two fishermen per boat used to go for the operation of the net. They operate the nets in the evenings and clear the catches in the following morning.

Twenty one adult milkfish were examined, which is the largest number of fish ever analysed from the wild from a particular centre in

India. Twenty fishes were collected from Ariyankundu and one from Appatheevu near Kilakkarai during the years 1979 to 1982.

After the fishes were weighed, meristic and morphometric characters were taken. All the 21 fishes were analysed for sex and stage of maturity. The weight of the internal organs such as gonads, heart, liver, stomach, gizzard, spleen and weight and length of intestine were

quantitatively giving percentage to each food item of the total food content of the stomach of the each fish. In order to find out the relationship between standard length and other morphometric characters and weight-fecundity, the general equation $Y=a+bx$ was employed whereas to find out the relationship between the length and weight, the total length and the fecundity and standard length and the fecundity, the curvilinear regression equation $Y=a+X^b$ was used.

RESULTS

Ariyankundu is identified as the best collection centre where about 100 numbers of adult milkfish are caught every year. The peak period for the catch of milkfish is January to April with a secondary period in October to December. At Ariyankundu, the sea forms a shallow bay with a stretch of coral and sand rocks with a depth of 4 to 6 metres.

The adult fish were obtained during January to April, October and December. Out of 21 adult milkfishes, 16 fishes were females and 5 were males. Data on the date of capture, place, total length of fish, weight, sex, weight of gonad, gonadosomatic index (GSI) values, average ova diameter, maturity stage and fecundity are presented in Table 1.

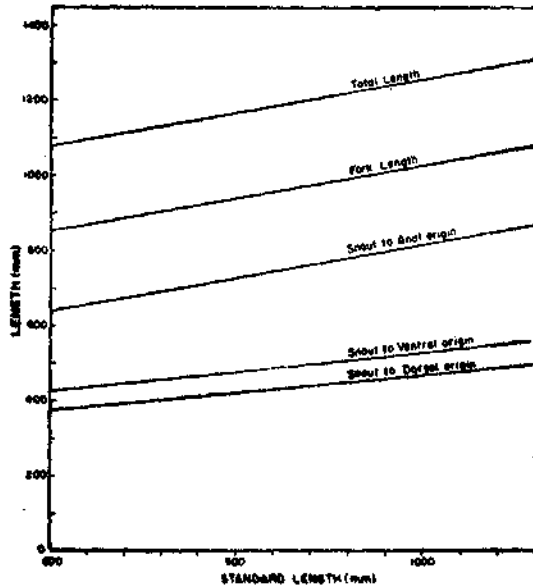


Fig. 3. Relationship between standard length and other morphometric characters of milkfish.

recorded from 8 fishes, in fresh condition. Fecundity estimation of the ova in the II and III stage fishes, was also done in fresh condition, counting the eggs in a portion of known weight and thereby calculating the total number from the total weight of the ovaries. The ovaries were preserved in 10% formalin for ova diameter study. For ova diameter frequency, 100 ova from the ovary of each fish were measured. Similarly the anterior spiral portion of the oesophagus region was analysed

It was observed that scales on lateral line ranged from 79 to 88 in number. Rows of scales above lateral line varied between 12 and 14 whereas the rows below lateral line were 12 or 13.

The total length, standard length and weight of the fishes were from 1042 to 1340 mm, 800 to 1059 mm 7 to 15 kg respectively. The total length and weight and standard length and weight relationship in its logarithmic form are as follows.

$$\text{Log } W = -5.9042 + 3.2304 \text{ Log. TL.}$$

$$\text{Log } W = -4.4502 + 2.8636 \text{ Log. SL.}$$

TABLE 1. Gonad weight, GSI and fecundity of adult milkfish

Date of catch	Place	Total length (mm)	Body weight (kg)	Sex	Gonad weight (gm)	GSI	Ova diameter	Maturity stage according to Tampi (1957)	Fecundity (Total No. of eggs*)
10. 4. 1978	Ariyankundu	1161	9.0	Female	909	10.10	0.67	III	..
"	"	1113	7.0	Male	73	1.04	..	II	..
25. 1. 1979	"	1075	7.0	Male	20	0.29	..	I	..
29. 1. 1979	"	1290	15.0	Female	310	2.07	0.37	II	3453047 (230)
30. 1. 1979	"	1270	15.0	"	1257	8.85	0.80	III	5321043 (355)
9. 2. 1979	"	1175	9.5	"	147	1.55	0.42	II	1424486 (150)
14. 2. 1979	Appa Island (Kilakarai)	1290	14.5	"	355	2.45	0.29	II	3516391 (243)
17. 2. 1979	Ariyankundu	1055	7.5	Male	19	0.25	..	I	..
18. 2. 1979	"	1235	14.0	Female	235	1.68	0.32	II	1777745 (127)
22. 2. 1979	"	1340	13.5	"	330	2.44	0.37	II	3420837 (253)
"	"	1152	11.4	"	920	8.07	0.71	III	3571939 (313)
23. 2. 1979	"	1294	14.0	"	1170	8.36	0.71	III	4450348 (318)
"	"	1042	9.0	Male	275	3.06	..	III	..
"	"	1145	10.5	Female	965	9.10	0.74	III	3896879 (371)
26. 2. 1979	"	1186	12.0	"	1090	9.08	0.76	III	3087744 (257)
4. 10. 1980	"	1120	9.0	"	35	3.90	..	I	..
13. 10. 1980	"	1069	7.0	"	14	2.00	..	I	..
"	"	1092	8.0	Male	11	1.38	..	I	..
15. 10. 1980	"	1170	8.0	Female	52	6.50	..	I	..
15. 12. 1980	"	1247	12.0	"	125	1.04	..	I	..
14. 03. 1982	"	1100	8.0	"	815	10.18	0.62	III	3291146 (411)

* No. of eggs per gram body weight of fish in parenthesis.

The correlation coefficient was calculated to be 0.887 and 0.867, indicating a high degree of correlation between total length and weight and standard length and weight (Fig. 1 and 2).

The regression lines of morphometric characters in relation to the standard length are presented in Fig. 3 and 4, based on the following equations.

Snout length	$-19.8748 + 0.0644x$
Anal ray length	$16.3441 + 0.0356x$
Eye diameter	$0.3227 + 0.0586x$
Depth at caudal	$38.7325 + 0.2105x$
Post-orbital length	$69.8354 + 0.0215x$
Inter-orbital space	$12.2713 + 0.0781x$
Ventral fin length	$47.4345 + 0.0498x$
Pectoral fin length	$50.8509 + 0.0933x$
Dorsal ray length	$837.8567 + 0.1073x$
Head depth	$3.6488 + 0.1568x$
Head length	$21.4988 + 0.1831x$
Maximum body depth	$57.5448 + 0.1515x$
Snout to dorsal origin	$-15.9901 + 0.4884x$
Snout to ventral origin	$6.2156 + 0.5242x$
Snout to anal origin	$62.1698 + 0.8759x$
Fork length	$133.2105 + 0.8992x$
Total length	$324.4190 + 0.941x$

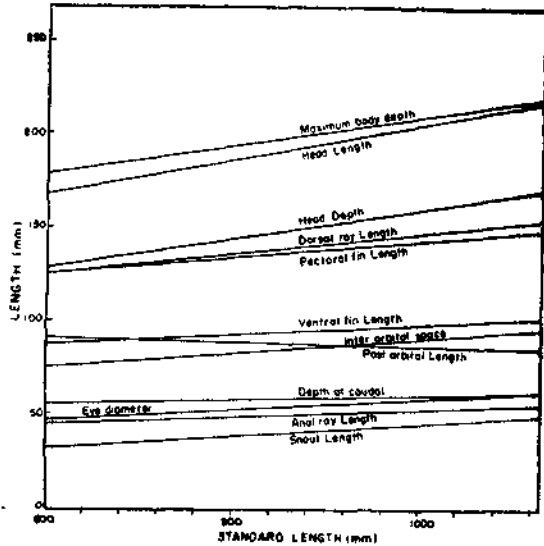


Fig. 4. Relationship between standard length and other morphometric characters of milkfish.

The regression lines reveal that snout to anal origin grows faster than snout to ventral origin and snout to dorsal origin. Maximum body depth stands in the 6th place in growth rate among the above mentioned characters. Head length grows faster than the head depth. A comparison of the relative growth of fin rays shows that the dorsal ray length grows faster than the pectoral, the ventral fin and the anal ray length. Interorbital space grows better

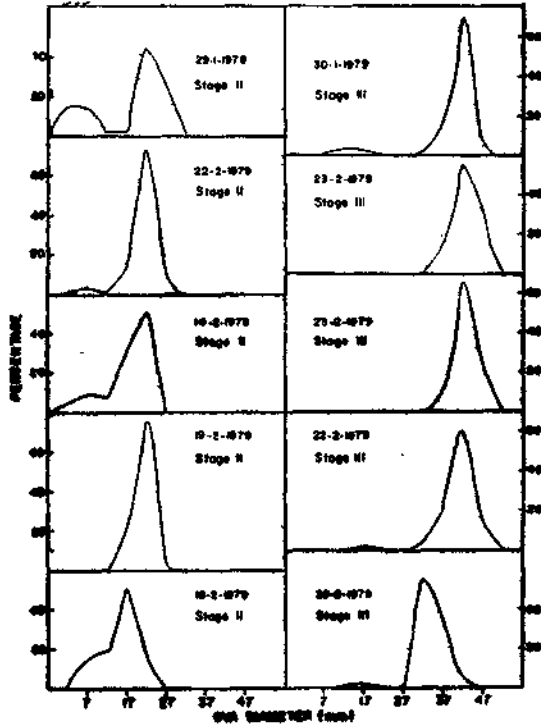


Fig. 5. Percentage frequency of ova diameter for 10 *Chanos chanos* with date of capture and maturing stage.

than postorbital length. Snout length, eye diameter and depth at caudal are having slower growth rate, when compared with other morphometric characters.

The weight of heart, liver, stomach, gizzard, spleen and intestine ranged from 10 to 30, 45

to 190, 25 to 90, 44 to 215, 10 to 30 and 113 to 250 g respectively. The length of the intestine varied between 2620 and 5350 mm (Table 2).

Analysis of stomach contents of adult milkfish (1069 - 1290 mm) revealed the presence predominantly of diatoms such as *Coscinodiscus*, *Thalassiothrix*, *Nitzschia*, *Navicula* and

matters ranged from 5 to 15, 5 to 10, 4 to 10, 4 to 10 and 5 to 35% respectively (Table 2).

The sizes of the female fishes varied between 1069 and 1340 mm in total length and 7 and 15 kg in weight. Among the 16 females, 5 fishes attained stage II of sexual maturity, whereas 7 fishes were in stage III. The length

TABLE 2. Weight (g) of internal organs and food items (% volume) of 8 adult milkfish

	Fish No.								Average
	1	2	3	4	5	6	7	8	
Total length (mm)	1290	1055	1235	1120	1069	1092	1170	1247	1160
Weight of fish	14500	7500	14000	9000	7000	8000	8000	12000	10000
" heart	25	10	30	18	15	15	20	25	20
" liver	45	100	105	52	60	63	70	190	86
" stomach	50	25	40	58	60	90	90	70	60
" gizzard	215	70	125	44	40	45	45	240	103
" spleen	15	13	30	16	13	10	10	20	17
" intestine	245	85	140	113	150	165	230	250	172
Length of intestine (mm)	4240	2620	4200	5350	4201	4800	4795	5000	4400
Diatoms	50	75	80	75	50	75	75	50	66
Gastropods	10	5	-	5	5	-	15	10	6
Copepods	5	10	5	10	-	-	5	10	6
Foraminifera	10	5	5	-	5	5	-	5	4
Mysids	5	-	5	-	5	10	-	5	4
Digested matter	20	5	5	10	35	10	5	20	14

Pleurosigma along with other food items such as gastropods, copepods, foraminifera, mysids and digested matters. The percentage of diatoms in the stomach content varied from 50 to 80%, whereas the percentage of gastropods, copepods, foraminifera, mysids and digested

of ovaries ranged from 370 to 461 mm and the weight from 14 to 1257 g. The GSI values for stages I and II of maturity of fishes were between 1.04 and 6.50, and 1.55 and 2.45 respectively and that of fishes in stage III were between 8.07 and 10.18. The average diameter

of the ova ranged from 0.29 to 0.80 mm. The ova of the fish in stage II form a mode mainly at 0.37 mm in the range of 0.27 to 0.42 mm. On the other hand, ova of fishes in stage III showed a mode mainly at 0.78 mm in the range of 0.62 to 0.80 mm (Fig. 5). Further progression in the ova diameter modes could not be traced due to lack of matured specimens beyond the stage III.

The sizes of male fishes ranged from 1042 to 1113 mm in the total length and 7 to 9 kg in

length and log standard length have been plotted against log fecundity (Fig. 6 and 7). The relationship has been expressed as $\text{Log Fecundity} = 2.0694 + 1.4364 \text{ Log Total Length}$ ($r = 0.2407$) and $\text{Log Fecundity} = -0.4172 + 2.3289 \text{ Log Standard Length}$ ($r = 0.4693$). The relationship of fecundity with weight of fish can be expressed as $\text{Fecundity} = 1242 + 171.39 \text{ Weight of fish}$ (Fig. 8).

The occurrence of spawning population of milkfish and fry in the Gulf of Mannar and

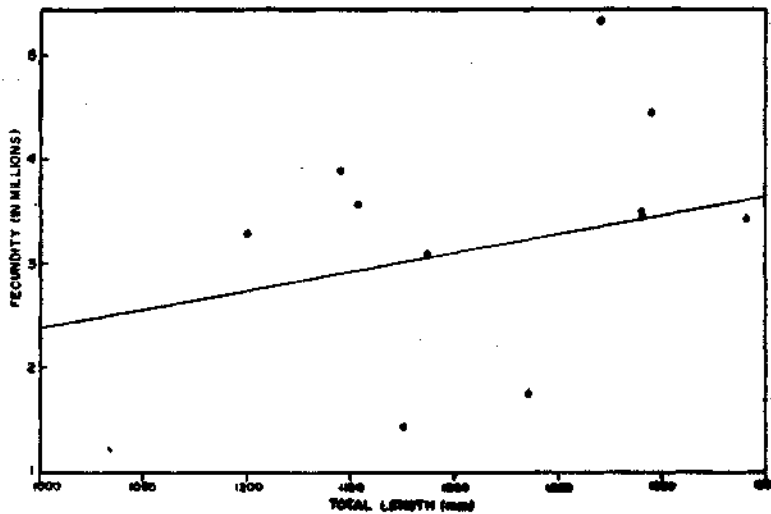


Fig. 6. Total length and fecundity relationship.

weight. The length of testes varied between 173 and 489 mm and that of weight 11 and 275 g. The GSI values were 0.25 to 1.38, 1.04 and 3.06 for the I, II and III stage of maturity respectively.

It has been observed from the fecundity estimation of ovaries of 11 fishes (1100 to 1340 mm), the maximum number of ova was 5321 thousand for the fish of total length 1270 mm and the minimum was 1424 thousand for the fish of total length 1175 mm. A linear relationship has been shown when the log total

length and log standard length have been plotted against log fecundity (Fig. 6 and 7). The relationship has been expressed as $\text{Log Fecundity} = 2.0694 + 1.4364 \text{ Log Total Length}$ ($r = 0.2407$) and $\text{Log Fecundity} = -0.4172 + 2.3289 \text{ Log Standard Length}$ ($r = 0.4693$). The relationship of fecundity with weight of fish can be expressed as $\text{Fecundity} = 1242 + 171.39 \text{ Weight of fish}$ (Fig. 8).

DISCUSSION

It was observed that scales on lateral line, scales above lateral line and scales below lateral line varied between 79 and 88, 12 and 14 and 12 and 13 respectively whereas Liao (1971) accounted 83 to 95 scales on the lateral line, 12 to 15 above the lateral line and 14 to 17

below the lateral line while he analysed nine adult milkfishes (778 to 1040 mm in total length and 4.02 to 10.6 kg in weight).

The maximum length and weight of fish during the present study were 1340 mm and 15 kg. Liao (1971) reported that the heaviest milkfish weighed 10.6 kg and the longest one measured 1040 mm whereas Tampi (1957) recorded the maximum length of 1260 mm and the maximum weight of 15.51 kg.

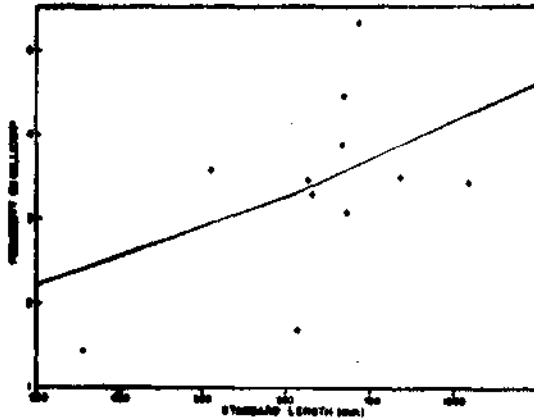


Fig. 7. Standard length and fecundity relationship.

Biometrical study reveals that the total length has the fastest rate of growth and the snout has the slowest rate of growth when compared to other morphometric characters.

It was found that the weight of the intestine was more than the weight of other internal organs. The present findings on food may be compared with the findings of Chacko (1945) who also reported the presence of *Fragillaria*, *Rhizosolenia* and *Trichodesmium* along with fish-eggs and larvae in the stomach content of milkfish. Tampi (1958) has recorded the food items of *Hypinia*, *Gracilaria*, *Polysiphonia*, *Nitzschia*, *Pleurosigma* and *Grammatophora* along with spats of *Pteria*, small gastropods, copepods, crustacean larvae and nematodes in adult *Chanos*.

It was observed that the maximum length and weight of ovaries were 461 mm and 1257g

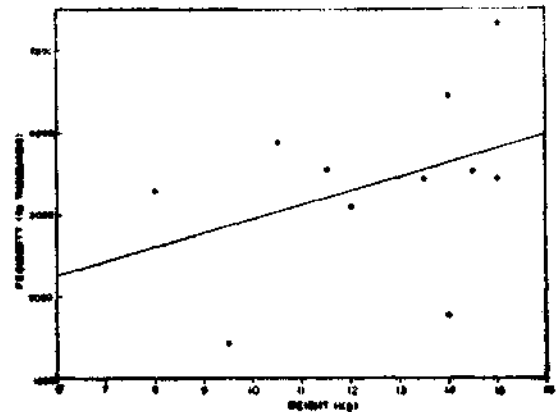


Fig. 8. Weight and fecundity relationship.

with GSI of 8.85 and the average diameter of the ova ranged from 0.29 to 0.80 mm whereas Liao (1971) mentioned that the largest pair of ovaries weighed 2.64 with GSI of 24.91 and the dark yellow eggs were quite separate and mature with the average diameter of 1.12 x 1.23 mm. Tampi (1957) reported that the maximum length and weight of ovary were 438 mm and 1405 g. During the present study it was recorded that the maximum length and weight of the testes were 489 mm and 275 g with GSI of 3.06 whereas Liao (1971) had stated in his note that there was only one male fish among the nine adult milkfish and the greyish white gonad weighed only 18.1 g and was not mature at all.

It was seen from the fecundity estimation of the ovaries of 11 fishes that the maximum and the minimum number of ova were 5321 and 1424 thousands as against the observation of Liao (1971) that the least number was 1319 thousand and the most was 3288 thousand eggs. Tampi (1957) recorded a maximum of 4896 and a minimum of 2118 thousand eggs.

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