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GROWTH, MORTALITY AND RELATIVE YIELD PER RECRUIT OF TWO TRIGLID SPECIES FROM THE EGYPTIAN MEDITERRANEAN, OFF ALEXANDRIA.

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ABSTRACT

Trigla lucerna *Linnaeus, 1758 and* ***Trigloporus lastoviza*** *(Brunich, 1768) are the most commercially important species of triglids in the Egyptian Mediterranean waters off Alexandria. Growth, mortality, relative yield per recruit and related parameters of these two species in the trawling catch were estimated from length-frequency data using compleat ELEFAN software. The estimated von Bertalanffy growth parameters were* $L_\infty = 40.3$ *cm &* $K = 0.287$ *year*$^{-1}$ *for* ***T. lucerna*** *and* $L_\infty = 34.7$ *cm &* $K = 0.372$ *year*$^{-1}$ *for* ***T. lastoviza.*** *Natural mortality, fishing mortality and exploitation ratio were 0.66, 0.83 year*$^{-1}$ *& 0.56 for* ***T. lucerna*** *and the corresponding ones were 0.81, 2.01 year*$^{-1}$ *& 0.71 for* ***T. lastoviza.*** *It is found that* ***T. lastoviza*** *is overexploited. Therefore management should be recommended for its fishery.*

INTRODUCTION

Gurnards or triglids are marine medium sized bottom fishes inhabit tropical and temperate seas. The Mediterranean Triglidae includes 5 genera and 8 species (Hureau, 1986), only ***Trigla lucerna***, ***Trigloporus lastoviza***, ***Aspitrigla obscura*** and ***Lepidotrigla cavillone*** were found in the Egyptian Mediterranean waters, off Alexandria. They constituted a considerable portion (3.4-4.5%) of trawling catches (Hashem, 1972; Rizkalla, 1992; Faltas, 1993).

As *T. lucerna* and *T. lastoviza* are the most commercially important species of triglids in the Egyptian Mediterranean waters, off Alexandria (Faltas, 1996), the present study deals with growth, mortality, exploitation ratio and relative yield per recruit of these two species aiming at giving information about their fisheries management.

MATERIALS AND METHODS

Monthly samples were collected from the commercial catch taken by the bottom trawlers operating in the Egyptian Mediterranean waters, off Alexandria during the period from October, 1994 to September, 1995. Individual fish lengths of the two species in the samples were recorded.

Growth parameters:

Size groups representing age classes in the length-frequency data were identified by using the method of Bhattacharya (1967) and application of modal class progression analysis (Gayanilo *et al.*, 1988) as incorporated in the compleat ELEFAN computer program which provides the growth increments. Growth parameter estimates were determined using the ELEFAN I computer program (Pauly & David, 1981, Pauly, 1987; Gayanilo *et al.*, 1988). This program fits a von Bertalanffy growth function to length data samples (Beverton and Holt, 1957). It has the form:

$$L_t = L_\infty \ (1 - e^{-K(t - t_o)})$$

where L_t is the length at time t, L_∞ is the asymptotic length, K is the growth constant and t_0 is the theoretical age at which L = 0.

Growth performance index ϕ by which K & L_∞ are correlated as:
$\phi = \log K + 2 \log L_\infty$ (Moreau *et al.*, 1986) was used to compare the overall growth.

Mortality coefficients and exploitation ratio:

Total mortality coefficient (Z) was estimated from length converted catch curve as built into ELEFAN II (Pauly, 1987) where the descending limb of the curve takes the form:

$$Ln\ (N/\Delta t) = a + bt.$$

where t is the age of fish, N is the fish frequency, Δt is the time taken to grow through the age group of fish and b is an estimate of -Z.

Natural mortality coefficient (M) was estimated from the empirical equation of Pauly (1980):

$$\log_{10} M = -0.0066 - 0.279 \log_{10} L_\infty + 0.6543 \log_{10} K + 0.4634 \log_{10} T.$$

where L_∞ & K are parameters of von Bertalanffy's growth equation and T is the mean annual water temperature, set at 22.5°C (Kamel, 1993).

Fishing mortality coefficient (F) and the exploitation ratio (E) were calculated by the method of Gulland (1971, 1983):

$$F = Z - M, \quad E = F/Z$$

Length at first capture (Lc_{50}):

ELEFAN II was used to construct a selection oogive by probability of capture by length extrapolating the catch curve (Pauly, 1984).

Relative yield per recruit (Y'/R):

According to Pauly and Soriano, (1986), ELEFAN II was used to calculate relative yield per recruit (Y'/R) from the estimated growth parameters, probability of capture and natural mortality coefficient.

RESULTS

Growth parameters:

The modal progression analysis of the pooled length frequency data suggested four age groups for ***T. lucerna*** and three age groups for ***T. lastoviza*** in the length frequency distribution (Table 1). The estimates of mean lengths of the four age groups were 11.79, 18.84, 24.33 and 28.23 cm respectively for the former species, whereas for the latter species were 9.00, 16.98 and 22.48 cm respectively for the three age groups.

The growth parameters of von Bertalanffy's equation were estimated as: L_∞ = 40.26 cm & K = 0.287 $year^{-1}$ for ***T. lucerna*** and L_∞ = 34.68 cm & K = 0.372 $year^{-1}$ for ***T. lastoviza.*** Growth performance index was 2.67 for ***T. lucerna*** and 2.65 for ***T. lastoviza.***

Table (1): Separation of length-frequency distributions using Bhattacharya's (1967) method.

Age group	*Mean length (cm)*	*Standard deviation*	*Population number*	**Separation index*
		T. lucerna		
I	11.79	3.410	210.730	---
II	18.84	2.254	863.730	2.487
II	24.33	1.378	63.320	3.023
IV	28.23	1.898	5.830	2.378
		T. lastoviza		
I	9.00	0.954	10.120	---
II	16.98	1.249	218.660	7.247
III	22.48	0.938	17.220	5.030

*should be > 2 for groups to be meaningfully separated.

Length at first capture (Lc_{50}):

It is defined as the minimum capture length i.e. the length at which 50% of a given species are retained by a specific gear (Beverton & Holt, 1957). From the selection oogives of the two species (Fig. 1) the estimates of L_{c50} were found to be 14.83 cm for ***T. lucerna*** and 13.44 cm for ***T. lastoviza.***

Mortality coefficients and exploitation ratios:

Total mortality (z) was estimated from the catch curve (Fig. 2). It was found that, mortality coefficients and exploitation ratio of ***T. lastoviza*** (Z = 2.65, M = 0.81, F = 2.01 & E = 0.71) were relatively higher than those of ***T. lucerna*** (Z = 1.49, M = 0.66, F = 0.83 & E = 0.56).

Relative yield per recruit (Y'/R):

Estimates of the relative yield per recruit were shown for different exploitation ratios for ***T. lucerna*** and ***T. lastoviza*** (Fig. 3). The results show that

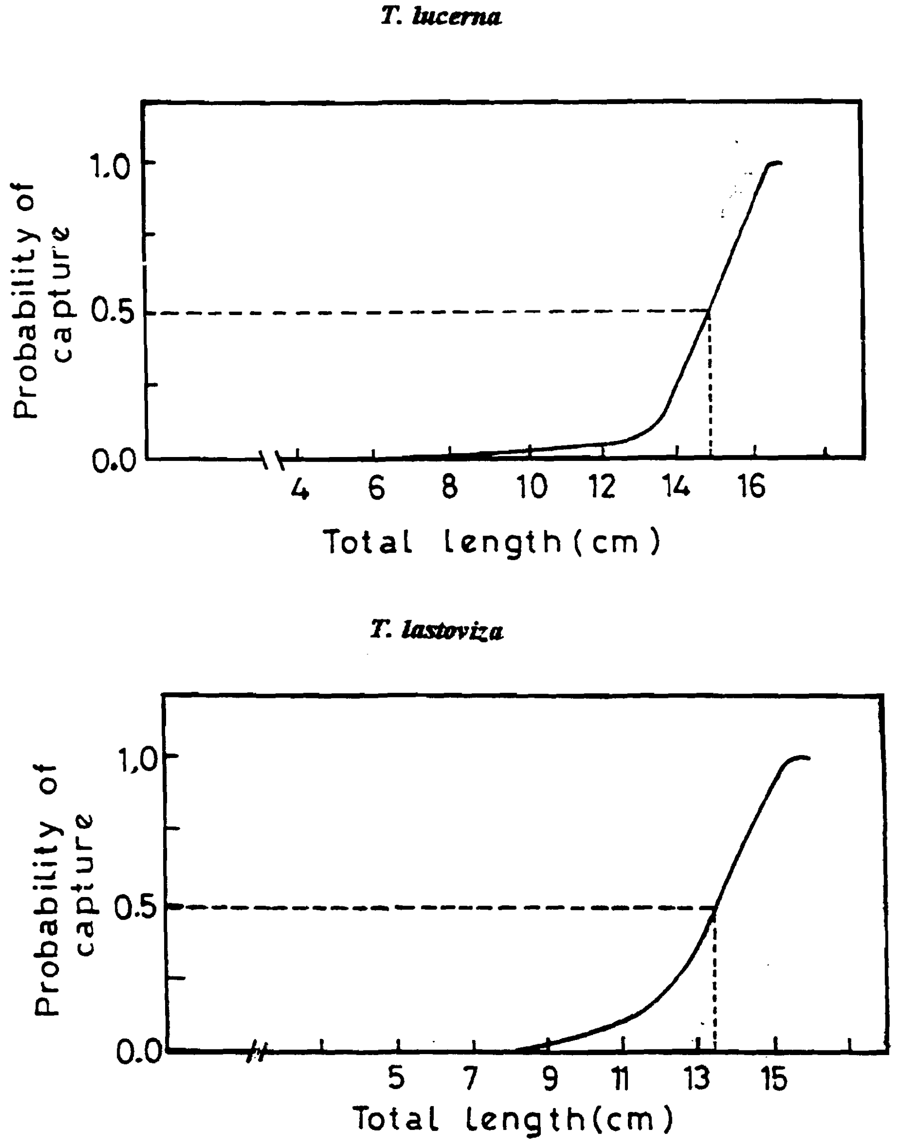

Fig. (1): Selection oogives for T. lucerna and T. lastoviza captured by trawling from the Egyptian waters, off Alexandria.

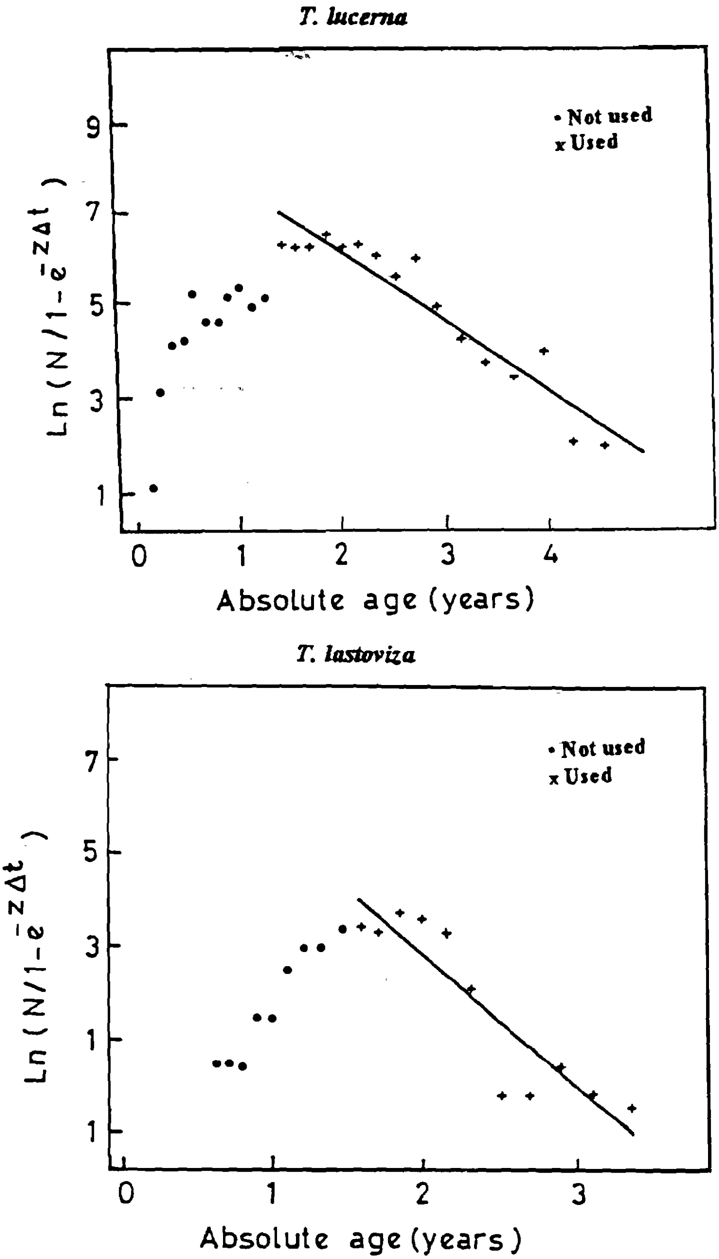

Fig. (2): Length converted catch curve of *T. lucerna* and *T. lastoviza* in the Egyptian Mediterranean waters off Alexandria.

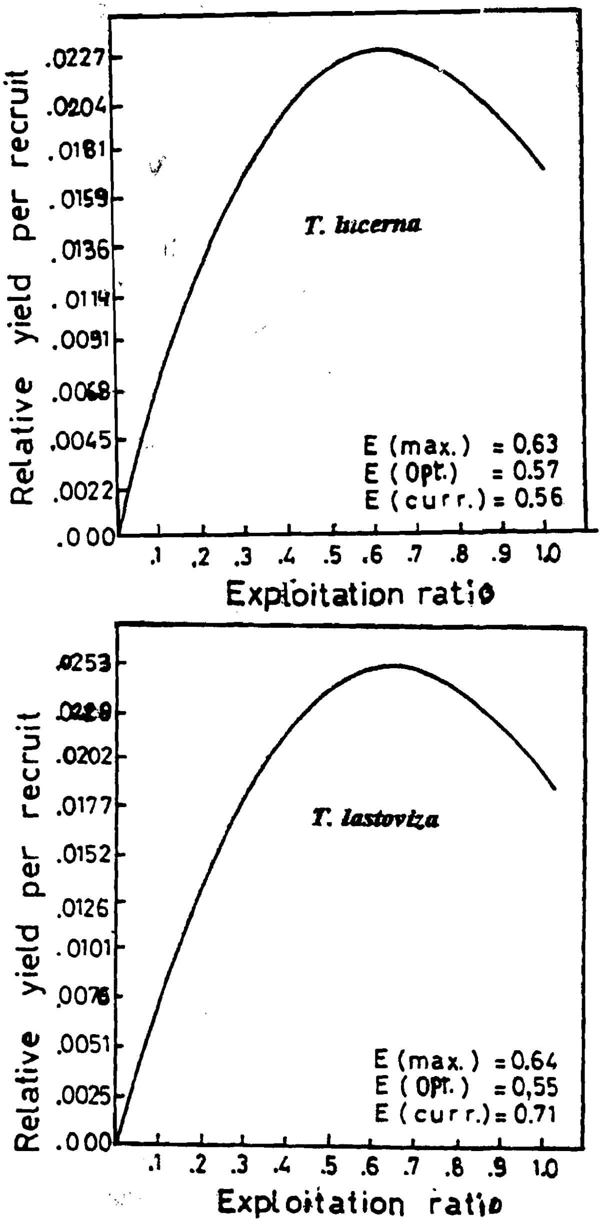

Fig. (3): Relative yield per recruit as a function of exploitation ratio for *T. lucerna* and *T. lastoviza* in the Egyptian Mediterranean waters, off Alexandria.

relative yield per recruit increases continuously with the increase of exploitation ratio (E) reaching its peak at $E_{(max)}$ = 0.63 for ***T. lucerna*** and 0.64 for ***T. lastoviza.***

DISCUSSION

Length-frequency distributions of the fish catch are among the basic data required for studying the dynamics of fish populations. The maximum size attained by *T. lucerna* and *T. lastoviza* varies widely in different geographical areas. In the present study, the maximum size attained was 32 cm T. L. (= 29.7 cm F. L.) for ***T. lucerna*** and 25 cm T. L. (= 23.8 cm F. L.) for ***T. lastoviza.*** These lengths were greatly less than those observed in other localities. (Table 2). This may be due to the fact that bottom trawling in our waters takes place in shallow rather than in deep waters.

Table (2): Maximum size (cm) of ***T. lucerna*** and ***T. lastoviza*** as given by various authors in different localities, compared with the present study.

Author	*Locality*	*T. lucerna*	*T. lastoviza*
Papaconstantinou, 1983	Greek Seas	44 F.L.	30 F.L.
Poll, 1947.	North Sea, Belgium	60 T.L.	40 T.L.
Lozano & Rey, 1952	Spanish Mediterranean	60 T.L.	32 T.L.
Bini, 1969	Italian Mediterranean	50 T.L.	40 T.L.
Dieuzeide, 1955	Algerian Mediterranean	60 T.L.	---
Seret & Opic, 1981	West African tropical Sea	---	30 T.L.
Baron, 1985	Dournenez Bay, France	70 T.L.	45 T.L.
Present work	Egyptian Mediterranean	32 T.L.	25 T.L.

Comparing the lengths of both ***T. lucerna*** and ***T. lastoviza*** at the end of each year of life determined by means of otolith readings as given by different authors with that obtained by the present study is shown in Table (3). It was found that the growth of the two species under study is lower than those reported for the same species in other localities.

Table (3): Lengths of *T. lucerna* and *T. lastoviza* at the end of each year of life as given by other authors in different localities, compared with the present study.

T. lucerna

Author	Collignon, 1968	Baron, 1985		Present study
Locality	Maroc	Douarnenez Bay		Egypt. Med.
Age	Sex combined	Female	Male	Sex combined
1	17	23	21	11.8
2	25	35	31	18.8
3	29	44	37	24.3
4	34	50	41.5	28.2
5	39	55	44	---

T. lastoviza

Author	Kartaz, 1971*	Baron, 1985	Present study
Locality	Catalane Sea	Douarnenez Bay	Egypt. Med.
Age	Sex combined	Sex combined	Sex combined
1	13	16.3	9.0
2	18.6	26.4	17.0
3	23.3	31.8	22.5
4	26.4	34.7	---
5	28.9	36.3	---

*Cited from Baron, 1985.

The asymptotic lengths of the two species under study (L_∞ = 40.36 cm for *T. lucerna* and L_∞ = 34.78 cm for *T. lastoviza*) were smaller than those estimated by Baron (1985) in Douarnenez Bay, France which were 66.8 & 48.4 cm for females & males of *T. lucerna* respectively and 39.5 for females & 36.9 cm for males of *T. lastoviza.* This may be due to the difference in the number of age groups obtained by various authors.

The estimated growth performance indices (ϕ) of the two species (ϕ = 2.67 for *T. lucerna* & 2.65 for *T. lastoviza*) were considerably lower than the corresponding values (ϕ = 3.03 for males & 3.15 for females of *T. lucerna* & 2.94 for males & 2.96 for females of *T. lastoviza*) detected in Douarnenez Bay. France (Baron, 1985). This can be attributed to that maximum size of fish caught were greatly less than those of the other locality.

T. lastoviza received more fishing effort as indicated from its high fishing mortality coefficient (F= 2.01) compared to ***T. lucerna*** (F= 0.83). Estimation of exploitation ratios indicated that ***T. lastoviza*** was over-exploited while ***T. lucerna*** was rationally exploited. The exploitation ratio realized as 0.71 & 0.56 for ***T. lastoviza*** and ***T. lucerna*** respectively. This ratio should not be more than 0.5 for the optimum condition of exploitation (Gulland, 1971). Estimation of the relative yield per recruit also indicated a clear evidence for over-fishing of ***T. lastoviza*** as maximum and optimum values (E_{max} = 0.64 & E_{opt} = 0.55) of exploitation were quite less than its current value (E_{curr} = 0.71), while for ***T. lucerna*** the optimum value (E_{opt} = 0.57) was highly compatible with its current exploitation ratio (E_{curr} = 0.56) i.e. it is rationally exploited.

Accordingly it is necessary to have more information about the preference to specific type of bottom, depth of distribution and ecology of ***T. lastoviza*** in addition to its different feeding pattern (Faltas, 1996) to define its geographical distribution and introducing the suitable management for its fisheries.

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