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Management and Reproduction of the Male Brushtooth Lizardfish *Saurida undosquamis* (Richardson) from Gulf of Suez, Egypt

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ABSTRACT

Age, growth and reproduction of *Saurida undosquamis* collected from Attaka fishing port from October 2004 to May 2005 was studied by examining 390 specimens caught by trawlers in Suez Gulf waters. The total length of males ranged between 9.5 cm to 29.8 cm. The length (L) – weight (W) relationship was estimated as W = 0.0042*3.1315. The age data derived from the length frequency data analyzed using the FISAT soft ware were used to calculate the growth parameters of the von Bertalanffy equation (1938). The estimated parameters were L_t = 31.03 cm, K = 0.44 and t_o = -1.059. The maximum age was 5 years. The 2-year age group was dominant in the catch. Macroscopic appearance of the testes demonstrated seven stages of maturity as virgin, maturing virgin , developing, developed, gravid, spawning and spent. Males recorded first sexual maturity at a total length 17.4 cm. Gonadosomatic index illustrated that this fish have prolonged spawning season nearly all the year round with main peak in May (2.6). The annual rates of total, natural and fishing mortality were calculated as 1.59, 1.32 and 0.27year^{-1} respectively. Exploitation rate E was estimated as 0.83. The relative yield per recruit was estimated using the parameters obtained for male. The results suggest that the present level of fishing and natural mortality are much higher than that gives the maximum yield per recruit.

Keywords: Gulf of Suez, male *Saurida undosquamis*, age, growth, first sexual maturity, reproductive biology, exploitation rates, yield per recruit.

INTRODUCTION

The preset study, which deals with the management and reproduction of *Saurida undosquami* (males) Richardson from the Gulf of Suez, Egypt is the second contribution in the study of growth and reproduction of this species.

Brushtooth lizardfish *Saurida undosquamis* is one of the most important commercial and economic fish species of family Synodonditae from Gulf of Suez. Family Synodontidae is represented in the trawl catch by five species; *Saurida tumbil, Saurida undosquamis, Saurida longimanus, Synodus hoshinonis* and *Trachinocephalus myops.* In the Gulf of Suez, *Saurida tumbil* is the most important constitute; about 65% of the Lizard fish, followed by *S. undosquamis* which contributes 33% of the catch, while the other three species are the least

abundant; appear occasionally in the catch (EL-Ganainy, 1997). The dynamics and reproductive biology of *Saurida undosquamis* have been studied in different localities (Rao, 1983; El-Ganainy 1992, 1997 & 2002 and Ramadan 1995 in the Gulf of Suez, Golani, 1993, Abdallah, 2002 and EL-Gresiy, 2005 in Mediterranean. Several studies of this species have been undertaken in localities other than Egypt: such as Siripakhavanich (1990) in Gulf of Thailand; Boonwanich (1991), Erzini (1991), Sousa (1992), Federizon (1993), Ismen (2003) in iskenderun Bay.

The present study deals with estimating the basic parameters required for assessing the status of *Saurida undosquamis* male from the Gulf of Suez in relation to gonad development and this information would help in the proper management of the Gulf of Suez trawl fishery and in the achievement of its optimum sustainable yield.

MATERIAL AND METHODS

Samples (390 fish ranging from 9.5 – 29.8cm TL) were collected from the Attaka harbour during the period from October 2004 to May 2005. The total length to the nearest millimeter, Samples were measured to study the length frequency distribution which divided into 1.0 cm length class .The relation between the total length (L) and total weight (W) was computed using the formula;$W = a L^b$ where a and b are constants whose values were estimated by the least square method.

The FAO-ICLARM Stock Assessment Tools (FiSAT; Gayanilo *et al.* 1997) was used for all computation, aging determined by Battacharya (1967) method which depended on analysis of length frequencies, the growth parameters (L_∞, K and t_o)of *Saurida undosquamis* females The growth performance index (ø) was computed according to the formula of Pauly and Munro (1984) as : $ø = \text{Log } K + 2\text{Log}L_\infty$.

The sex and maturity stage of each specimen were determined by visual and microscopic examination of the gonads. The stages of maturation were classified according to Holden and Raitt's (1974) scale. The gonado somatic index (GSI) was calculated monthly by the equation:

GSI = (gonad weight/fish weight without gonad)*100

The total mortality coefficient "Z" was estimated using the method of Pauly (1983a). The natural mortality coefficient "M" was estimated using the formula of Pauly (1980), while the fishing mortality coefficient "F" was estimated as: $F = Z - M$.

The exploitation rate "E" was calculated using the formula of Gulland(1971) as: $E = F/Z$.

The length at first capture "L_c" was estimated by the analysis of catch curve using the method of Pauly (1984a&b).

Several analytical models are used for the estimated of yield per recruit. The most often used model is that of Beverton and Holt (1957). The model is based on the calculation of yield per recruit under a particular set of fishing mortality and age at first capture. The model can be written in the form suggested by Gulland (1969) as follows:

$$\frac{Y}{R} = Fe^{-M(t_c - t_r)} W_\infty \left(\frac{1}{Z} - \frac{3S}{Z+K} + \frac{3S^2}{Z+2K} - \frac{S^3}{Z+3K}\right)$$

where:-

Y/R = *yield per recruit*

T_c = *age at first capture.*

T_r = *age at recruitment.*

Where

$$S = e^{-K(T_c - t\circ)}$$

K = *von Bertallanffy growth parameter.*

$W\infty$ = *asymptotic body weight*

M = *natural mortality coefficient.*

The age at first capture (Tc) was calculated by converting the length at first capture (Lc) to age by means of the von Bertalanffy growth equation:

$$T_c = -\frac{1}{K} \ln\left(1 - \left(L_c / L_\infty\right)\right) + t$$

(Tr) was computed by the conversion of the length at recruitment (Lr) using the following version of the von Bertalanffy formula as follows:

$$T_r = -\frac{1}{K\,Ln\left[(1-(L_r/L_\infty)\right] + t_o}$$

RESULTS AND DISCUSSION

I- Age Determination

Age of male *Saurida undosquamis* in the Gulf of Suez was estimated according to the analysis of length-frequencies data using the Bhattacharya (1967) method .The obtained results revealed that the maximum life span of *Saurida undosquamis* males is fife years at length of 13.99, 20.24, 24.13, 26.01and 28.05 cm.(Fig. 1). This agrees with the finding of EL-Ganainy (2004).

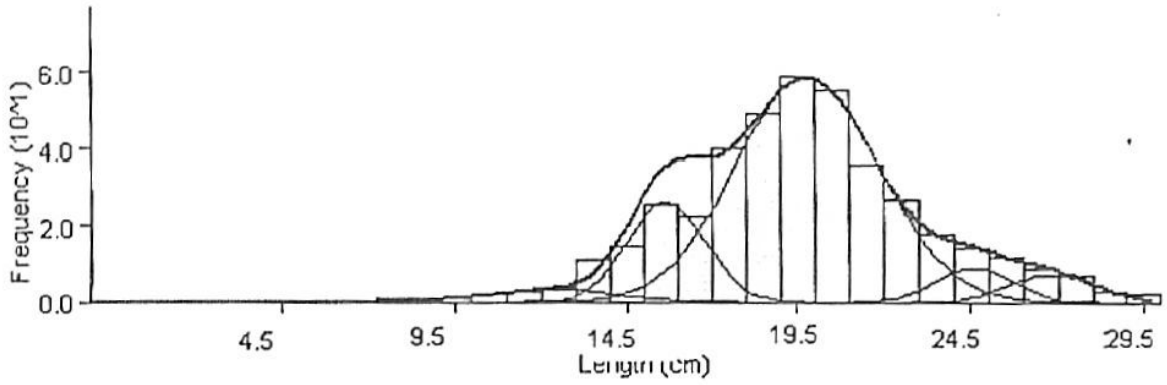

Figure 1: Bhattacharya method of *Saurida undosquamis* males from the Gulf of Suez.

II- Length - Weight Relationship

Length and weight measurements of 390 specimens were used to describe the length-weight relationship of *Saurida undosquamis* males in the Gulf of Suez (Figure 2). Their total lengths varied between 9.5 and 29.8 cm, while the total weights ranged between 17.4 and 160.5 g. The obtained equation was as follow:

$$W = 0.0042\ L^{3.1315} \quad (r = .985)$$

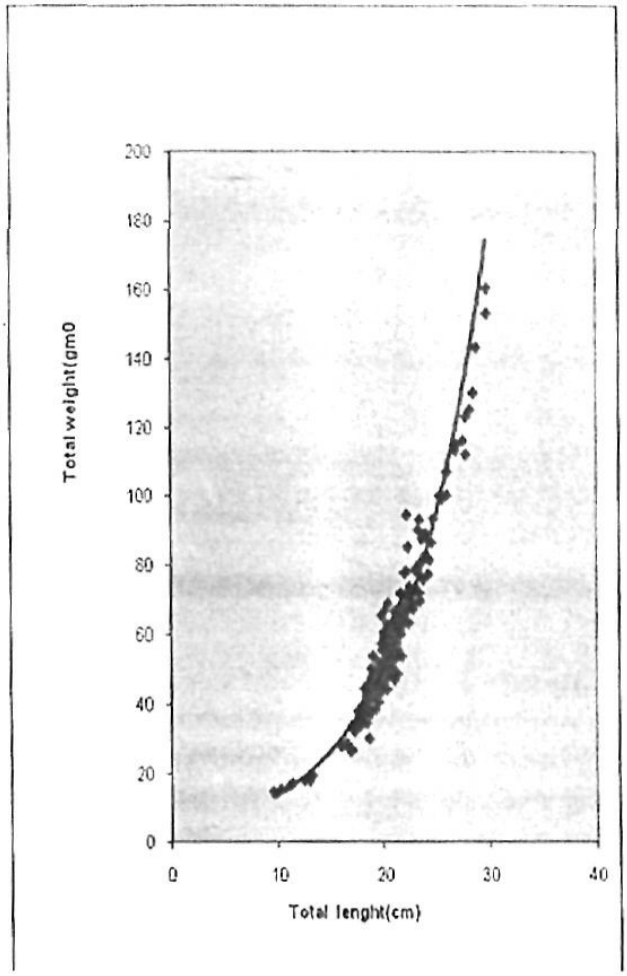

Figure 2: Lenght-weight relationship of *Saurida undosquamis* males from the Gulf of Suez.

III- Growth Parameters

The von Bertalanffy growth parameters (L_{∞}, K and t_o) were estimated and the obtained equations were as follow:

For growth in length $L_t = 31.03\ (1 - e^{-0.4\ (t+1.3)})$

For growth in weight $W_t = 197.14\ (1 - e^{-0.4\ (t+1.3)})^{3.1315}$

IV- Growth Performance Index (ø)

The growth performance index (ø) of *Saurida undosquamis* males was computed as 2.63.

V- Mortality Rates

The results from Figure (3) indicate that the total mortality coefficient "Z" was estimated as 1.59 $year^{-1}$. The value of natural mortality coefficient "M" was estimated as 0.27$year^{-1}$, while fishing mortality coefficient "F" was estimated as 1 .32 year.

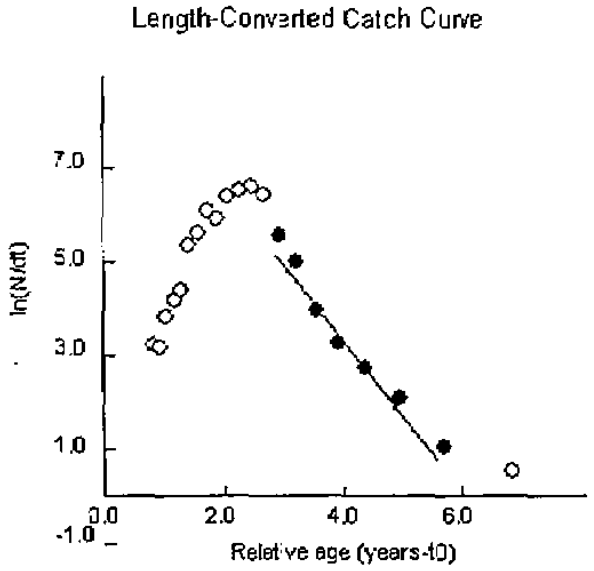

Figure 3: Estimation of Z of *Saurida undosquamis* males from the Gulf of Suez.

VI- Exploitation Rate "E"

Exploitation rate "E" was computed using the formula of Gulland (1971) and the obtained E was 0.83. Gulland suggested that the optimum exploitation rate is about 0.5, so the high value of the present exploitation rate indicated that the stock of *Saurida undosquamis* males is overexploitated and to maintain this valuable fish resource, the exploitation rate should be reduced below the optimum value as well as increase the length at first capture to be about 20cm.

VII- Length and age at first capture "L_c"

The length at first capture was obtained as $L_{50\%}$ = 15.79cm, which corresponded to an age of 1.81 (Fig. 4).

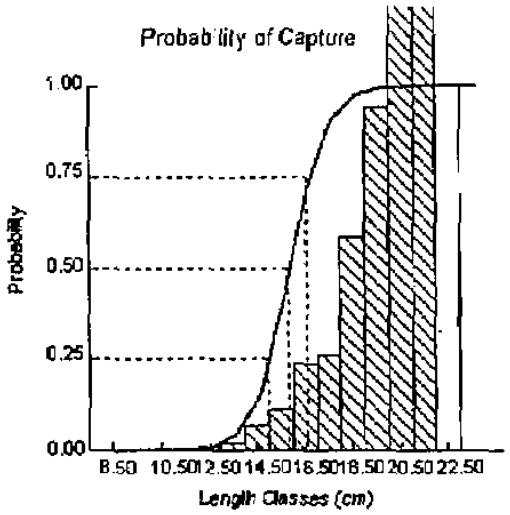

Figure 4: Length at first capture Lc of *Saurida undosquamis* males from the Gulf of Suez.

Stage VI (Spawning): Testes are slightly shrinked and flaccid but not completely hollow due to discharge of milt during the spawning process. The testes are white in colour.

Stage VII (Spent): Testes are reduced in size. They are shrunken and collapsed. They are deep white colour.

This result coincides with Latife and Shenoda (1973), Ramadan (1995) and EL-Greisy (2005).

IX- Length at first sexual maturity "L_{50}"

Size at first sexual maturity helps to determine the minimum size that must be avoided in order to protect an adequate spawning stock and ensure at least one spawning for the mature individual. The percentage study divided length of male *S. undosquamis* to different groups and classified them into two main categories; Immature (fish of stages I & II) and mature (stages from III to VII) individuals. Mature individuals of male *S. undosquamis* reach first sexual maturity with percentage 50 % at 17.4 cm. Figure (5) demonstrated that all males with total length less than 15 cm are immature, while other fish longer than 21 cm are mature.

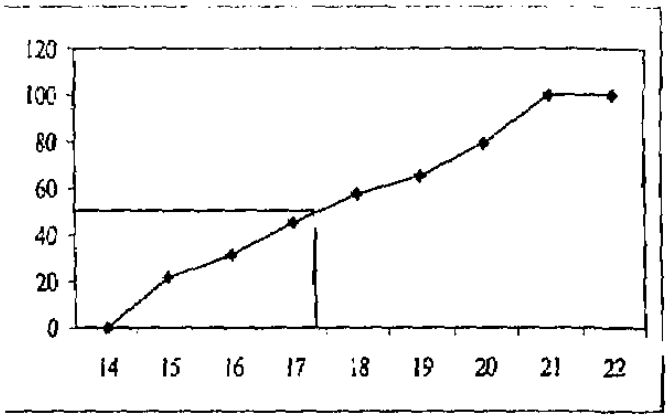

Figure 5: Length at first sexual maturity for male *Saurida undosquamis* collected from gulf of Suez, Red Sea, during the period from October 2004 to June 2005.

Faltas (1993) recorded a range of (15-19 cm) for the same species. Latife and Shenoda (1973) recorded (16 cm) in the Gulf of Suez. This was indicated through studies, which were taken in other regions in the same species such as Budnichenko & Dimitrova, 1979 recorded (12 - 13 cm) in the Arabian sea. These different data from different regions means that length at first sexual maturity are related to the environmental conditions.

X- Gonado somatic index (GSI)

Monthly fluctuations of GSI values are shown in Fig. (6). GSI values range between a minimum value 0.64 in November and a maximum one 2.6 in May. The spawning period showed different peaks but the main one was demonstrated in May. This means that this fish is prolonged spawning. This results agree with Ramadan (1995) and EL-Gresiy (2005), who indicated that the main GSI occurs in May although the spawning stages found all the year around.

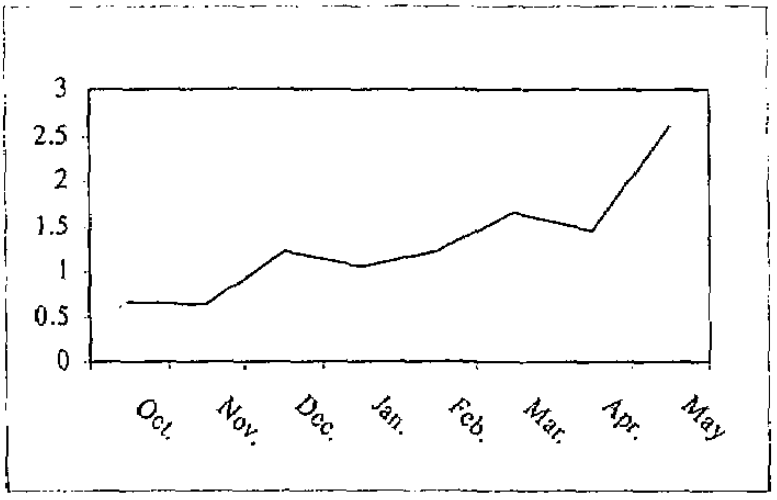

Figure 6: Monthly variation of the average Gonado-Somatic Index of male *Saurida undosquamis* from gulf of Suez, Red Sea, during the period from October 2004 to May 2005.

XI- Yield per recruit

The yield per recruit of *Saurida undosquamis* collected from the Gulf of Suez during October 2004 to May 2005 was estimated by using Beverton and Holt (1957) model. The following parameters values were used in the calculation:

L_{∞}=31.03 cm W_{∞} =198.49 K=0.395year *to* =.31 Lr=9.5 cm

Lc=variable M=0.27 year Z=1.59 year F= variable

The results are graphically represented in Fig. (7). From the graph it is evident that, the yield per recruit is zero when the fishing mortality is zero, then the yield per recruit increases rapidly as the fishing mortality increases and reached its maximum value at fishing mortality coefficient of(0.5)after which the yield per recruit decreases with further increasing of fishing mortality. Figure show also that at the present level of fishing mortality (F= 1.32 per/year), age at first capture (Tc= 1.306 year) and natural mortality coefficient (M= 0.27 per/year) the yield per recruit was estimated to be(33.04) gm. This mean that ,the present level of fishing mortality is higher than that which gives the maximum yield per recruit and to obtain the maximum yield per recruit 37.16gm, the fishing mortality coefficient must be reduced from 1.32 to 0.5(62.12%).

To determine the most appropriate age at first capture "Tc" of *Saurida undosquamis* from the Gulf of Suez, which is related to the estimation of the optimum mesh size, the yield per recruit was calculated by applying different values of Tc(2.306and 3.306 years with the present value 1.306 year).the results indicate that with the increasing of Tc a higher yield per recruit can be obtained. It is obvious also that if Tc is 2.306 instead of 1.306 year a maximum yield per recruit of 44.13gm can be obtained at fishing mortality of 1.1 which is close to the present level (F=1.32). It is notes also that at Tc =3.306 years a maximum

yield per recruit of 47.19gm is obtained. This mean that, the present level of Tc is not the optimum Tc of this fish species in the Gulf of Suez and it must be increase.

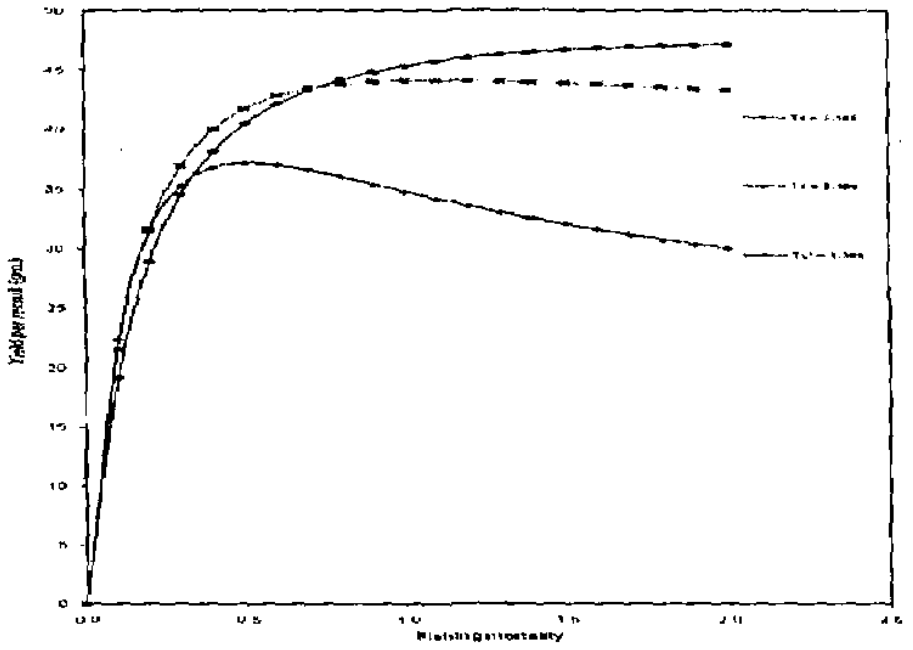

Figure 7: Yield per recruit (gm.) of *Saurida undosquamis* (males) from the Gulf of Suez as a function fishing mortality and age at first capture.

To study the variation in the yield per recruit according to the change of the natural mortality coefficient "M", the yield per recruit of *Saurida undosquamis* was estimated by using different values of "M" and the obtained results represented graphically in Fig. (8) which clear that the yield per recruit decreases with the increase of the natural mortality coefficient.

It is also evident that at the present level of the fishing mortality coefficient (F=1.32) and age at first capture (Tc=1.306year)a higher yield per recruit can be obtained(37.89 instead of 33.04gm) when the natural mortality coefficient decreased (0.19 instead of 0.27) if the natural mortality coefficient is higher than the present level(0.35instead of 0.27) a lower value of yield per recruit was obtained (28.86gminstead of 37.98gm) (Fig. 8).

This means that the yield per recruit decreases with the increasing of natural mortality coefficient and the habitat conservation can increase the yield per recruit through the protection of the nursery ground as well as the protection from pollution and illegal fishing.

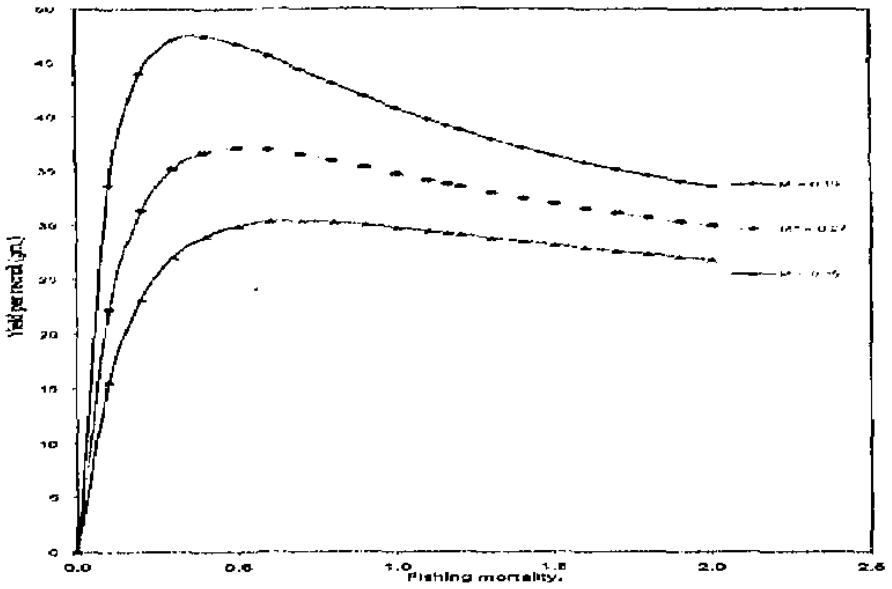

Figure 8: Yield per recruit (gm.) of *Saurida undosquamis* (males) from the Gulf of Suez as a function fishing mortality and natural mortality.

The obtained results are in a good agreement with the finding of Sanders *et al.* (1984). They stated that the stock of *Saurida undosquamis* in the Gulf of Suez is fully exploited and any addition in the fishing effort will be associated with a decrease in the catch.

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