Advances in Biological Research 7 (4): 124-128, 2013
ISSN 1992-0067

DOI: 10.5829/idosi.abr.2013.7.4.73144

# Population Parameters and Length-Weight Relationship of Thinspine Sea Catfish (*Plicofollis tenuispinis*) in Northwest of Persian Gulf (Khuzestan Coastal Waters, Iran)

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**Abstract:** During this study from December 2009 to November 2011, 403 Thinspine sea catfish fish were caught and their weight and length were measured. Total number of caught fishes included, 33 males, 77 females and 293 immature fishes. The Mean, maximum and minimum total lengths were 236±82, 470 mm and 121 mm respectively. The Mean, maximum and minimum total weight for this species was 184±150 g, 1385 g and 14g respectively. The length-weight relationship were calculated as $W=0.000006\ FL^{3.07}$ ($n=77$, $R^2=0.98$) for females, $W=0.000004FL^{3.15}$ ($n=33$, $R^2=0.98$) for males and $W=0.000007\ FL^{3.08}$ ($n=403$, $R^2=0.98$) for total fishes verifying calculated b with 3, using Students t-test there was significant difference between calculated b and 3 ($P<0.05$). Population parameters were calculated for total fish as below, $L_\infty$: 61 (cm); K: 0.2 ($year^{-1}$); $t_0$: -0.69 and $\Phi'$: 2.87 respectively. Based on results, this species is classified as mediate vulnerable group fishes.

**Key words:** Population Parameters · Thinspine Sea Catfish · Persian Gulf

## INTRODUCTION

The Persian Gulf is a semi enclosed sea that laying almost between the latitudes of 25°-32° N and longitudes of 48°-56° E. This water basin is shallow continental shelf and average of depth was 35m, which is increasing from Arvend estuary and reach to maximum in strait of Hormuz Strata. This local is considered one of the richest areas in fishery resources where large quantities of fish and shrimps are concentrated in different locations, particularly in the territorial waters of the State of Iran [1]. Overall purpose of fisheries science is to provide decision-makers with advice on the relative merits of alternative management. Demography rates are fundamental to fisheries stock assessment and estimated of potential yield [2]. In tropical waters; lack of distinct seasonality has made such analyses more difficult [3]. The Ariidae or ariid catfish are a family of catfish that mainly live in marine waters with many freshwater and brackish water species. They are found in shallow temperate and tropical seas around the coastlines of North and South America, Africa, Asia and Australia. They are absent from Europe and Antarctica [4]. *P. tenuispinis* found in coastal waters down to a depth of about 50 m [5]. The Thinspine sea catfish lives in the demersal, amphidromous and depth range 20-50 m environment [6]. and also, feeds mainly on invertebrates and small fishes. Thinspine sea catfish caught mainly with bag nets, dip nets, bamboo stake traps and on hook and line [5]. Different aspects of biological Parameters of *P. tenuispinis* have been studied by different authors are those of Talwer and Jhingran [7], in Indian waters (Waltair, Visakhapatnam). However, no study so far has been made on this species population parameters in Khuzestan Coastal Waters (northwest of Persian Gulf). In this context, the aim of the present study was twofold: (i) to estimate its population parameters via length frequency methods (ii) to determine the length-weight relationship of the population of this species in Khuzestan Coastal Waters (northwest of Persian Gulf). Results will greatly contribute to elaborating management programs for this economically important fish species of the region under study.

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## MATERIALS AND METHODS

The main fishing areas of P. tenuispinis in the northwest of Persian Gulf are located in Liphe-Busafe and Bahrekan fishing area between 29° 44' to 07 'N and 48° 45' to 49° 50'. A total number of 403 individuals of *P. tenuispinis* were captured during 2009 to 2011 using bottom trawl and gill net. Also, this collected from recreational fishermen and then transferred in ice box to the laboratory. In the laboratory, Fork length (±1.0 mm), sex and weight (±0.001 g wet weight) were recorded for each fish. Parameters of the length weight relationship were obtained by fitting the power function $W = a \times FL^b$ to length and weight data where: W is the total wet weight, a is constant determined empirically, FL is the fork length [8]. In order to verify if calculated b was significantly different from 3, the Students t-test was employed [9]. The data were pooled monthly from different landing sites and subsequently grouped into classes of three centimeter intervals. The data were analysis using FiSAT II (FAO-ICLARM Stock Assessment Tools) as explained in details by Gayanilo *et al.* [10]. Growth was calculated by fitting the von Bertalanffy growth function to length frequency data. The von Bertalanffy growth equation is defined as follows [3]: $L_t=L_\infty\ [(1\text{-}\exp\ (\text{-}K\ (t\text{-}t_0))]$, Where $L_t$ is length at time t, $L_\infty$ the asymptotic length, K the growth coefficient and $t_0$ is the hypothetical time at which length is equal to zero. The $t_0$ value estimated using the empirical equation [11]. $\text{Log}_{10}(\text{-}t_0) = \text{-}0.3922\text{-}0.2752\ \text{Log}_{10}L_\infty\text{-}1.038\ \text{Log}_{10}K$. The fitting of the best growth curve was based on the ELEFAN I program [12], which allows the fitted curve throughthe maximum number of peaks of the length-frequency distribution. With the help of the best growth curve, growth constant (K) and asymptotic length ($L_\infty$) were estimated.

The growth performance (Φ') of P. Tenuispinis population in terms of length growth was computed using the index [12]. $\Phi\times = \text{Log}_{10}K + 2\ \text{Log}_{10}L_\infty$. Statistical analyses were performed with SPSS 14 software package and a significance level of 0.05 was adopted.

## RESULTS

During this study from December 2009 to November 2011, 403 Thinspine sea catfish fish were caught and their weight and length were measured. The main fishing areas of *P. tenuispinis* the in northwest of Persian Gulf are located in Liphe-Busafe and Bahrekan fishing area between 29° 44' to 07 'N and 48° 45' to 49° 50' (Fig. 1).


Fig. 1: Location of two landing sites of Thinspine sea catfish in northwest of Persian Gulf (Iran)

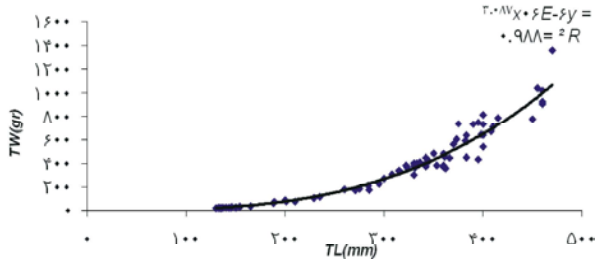


Fig. 2: The length-weight relationship curve for female fish of Thinspine sea catfish in northwest of Persian Gulf (Iran)

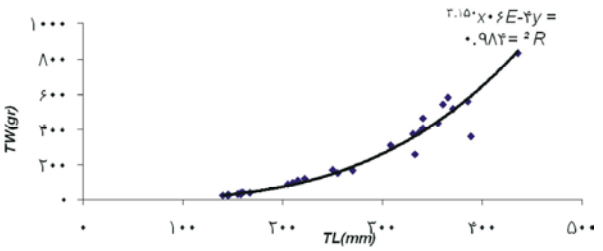


Fig. 3: The length-weight relationship curve for male fish of Thinspine sea catfish in northwest of Persian Gulf (Iran, 2009-2011)

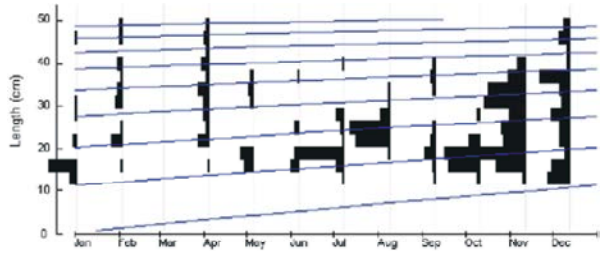


Fig. 4: Growth curve of Thinspine sea catfish from Iran by ELEFAN I superimposed on the restructured length-frequency diagram ($L_\infty$= 61 cm and K= 0.2yr$^{-1}$)

Total number of caught fishes included, 33 males, 77 females and 293 immature fishes. The Mean, maximum and minimum total lengths were 236±82, 470 mm and 121 mm respectively. The Mean, maximum and minimum

Table 1: Length characteristics (mm) and Weight characteristics (g) of Thinspine sea catfish in northwest of Persian Gulf (2009-2011)

| | | Length characteristics (mm) | | | Weight characteristics (g) | | |
|---|---|---|---|---|---|---|---|
| Sex | n | Min | Max | Mean ± SD | Min | Max | Mean± SD |
| Males | 33 | 205 | 470 | 260±94 | 88 | 836 | 241±231 |
| Females | 77 | 130 | 450 | 305±101 | 21 | 1385 | 379±290 |
| Immature | 293 | 121 | 365 | 218±103 | 14 | 488 | 118± 101 |
| Total | 403 | 121 | 470 | 236±82 | 14 | 1385 | 184±150 |

total weight for this species was 184±150 g, 1385 g and 14 g respectively (Table 1).

**Length-Weight Relationship:** The length-weight relationship were calculated as $W=0.000006FL^{3.07}$ (n=77, $R^2$= 0.98) for females, $W=0.000004FL^{3.15}$ (n=33, $R^2$=0.98) for males and $W=0.000007FL^{3.08}$ (n=403, $R^2$= 0.98) for total fishes (Figs. 2 & 3), verifying calculated b with 3, using Students t-test there was significant difference between calculated b and 3 ($P<0.05$).

**Growth Studies:** As the study has allowed the estimation of several pairs of growth constant values, a mean value was sought by trying the Response Surface Analysis routine. The best fit given by method, Population parameters were calculated for total fish as below, $L_\infty$: 61 (cm); K: 0.2 ($year^{-1}$); $t_0$: -0.69 and Φ': 2.87 respectively (Fig. 4).

## DISCUSSION

The length-weight relationship in fish is of great importance in fisheries assessments [13]. Length and weigh relationship in conjunction with age data can give information on the stock composite, age at maturity, life span, mortality, growth and production. The relative robustness or degree of well-being of a fish expressed as the coefficient of condition (condition factor) is an important tool for the study of fish biology, mainly when the species lies at the base of the higher food web [14]. The difference in the 'b' value of male and female indicated that the male were heavier than the females of the same length group. In the present study the mean value of 'b' is 3.15 in males and 3.07 in females. It means the value of 'b' in males is more than the females. The b values in the weight-length model were measured close to 3 for Thinspine sea catfish fishes that indicating that weight increased allometrically with length [2]. The value of b for Indian waters (Waltair, Visakhapatnam) was estimated 2.88 for both sexes [7]. The variation of b in the different regions could be by seasonal fluctuations in environmental parameters, physiological conditions of the fish at the time of collection, sex, gonad development and nutritive conditions in the environment of fish [8]. In present study, length- weight (a) value was 0.0208 and the value of (a) for Indian waters (Waltair, Visakhapatnam) was estimated 0.018 for both sexes [8]. In length- weight (a) value is related to fish condition. Also (a) depends on weight and it can be used as status value [7]. Length–weight relationship is a practical index of the condition of fish and may vary over the year according to several exogenous and endogenous factors such as food availability, feeding rate, health, sex, gonad development, spawning period and preservation techniques [15, 16]. According to Marthin [17] the range of "b" could be from 2.5 to 4 and Tesch [16] believed "b=3 in fish with isometric growth. Talwer and Jhingran [7], estimated infinity length and growth coefficient of Thinspine sea catfish 82 cm and 0.21 $y^{-1}$ in Indian waters (Waltair, Visakhapatnam). In the present study $L_\infty$ and K of Thinspine sea catfish indicated lower infinity length and growth coefficient. Unfortunately, no references from other studies for $L_\infty$ and K are available regarding this species. Parsamanesh *et al*. [18] estimated $L_\infty$ and K of *Arius thallassinus* 91 cm and 0.11 $y^{-1}$ in northwest of Persian Gulf (Khuzestan Coastal Waters, Iran). Differences between recorded $L_\infty$ and K are influenced by ecological characteristics, population size and gene frequency of species considering their habitat and according to natural selection, appear different adaptation pattern during their life [19]. L4 and K amounts have reverse correlation and with decrement $L_\infty$, amount of K increases and vice versa [3]. Differences in growth rates between regions indicated a stock separation [20] which has, in some cases, supported a genetic difference [21]. Age at zero length ($t_0$) were calculated as -0.18 for this species in Indian water [7]. With negative $t_0$ values, juveniles grew more quickly than the predicted growth curve for adults and with positive $t_0$ values, juveniles grew more slowly [2]. Values of Φ' for *P. tenuispinis* available from other studies has 3.51 in Indian waters [7]. The estimate obtained in our study (2.87) compares with the upper of other studies. A method of validating growth parameters involves the comparison of growth performance indices (Φ') in terms of growth in length with

other estimates obtained for the same or a similar species [22]. According to biological characteristics and with compare to American Fisheries Society (AFS) indices [23], Thinspine sea catfish is classified as mediate vulnerable group fishes. Further research as stock assessment is needed in order to obtain an adequate and comprehensive understanding of biology and ecology in this important order in future.

## ACKNOWLEDGMENTS

We are very grateful the experts of the South of Iran aquaculture fishery research center, Ahwaz for helping the project work.

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