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Size at first maturity and maturity stages of *Terapon puta* (Cuvier, 1829) from Pondicherry coast, India

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Abstract
Size at first maturity of *Terapon puta* was studied on 32 male (12 to 20 cm in TL) and 163 female (12 to 22 cm in TL). The Logistic curves describing the relationship between the sexes and the proportion of 50% maturity (Lm_{50}) were estimated at 16.4 cm in male and 16.7 cm in female of *Terapon puta*. The male reached 50% first sexual maturity at smaller lengths than female in this species. The gonads were classified into five maturity stages based on the size, colour and texture. Month wise predominance of different stage of maturity deferred during different months.

Keywords: Maturity stages, 50% maturity, *Terapon Puta*, Reproductive Cycle, Sexual Maturity, Pondicherry coast.

1. Introduction
Terapon puta belong to the family teraponidae is a medium size food fish which inhabits the sea, backwater and estuaries in Pondicherry coast. Though they are not commercially important, they together constitute a regular fishery throughout the year. The knowledge on length at maturity and spawning season detects when and at which length the fish should be protected and therefore it is important for the proper management and conservation of fish stocks [1]. The most suitable method of determining the reproductive cycle of fishes is to observe the seasonal development changes in their gonads [2, 3]. The reproductive cycle of fishes is closely tied to the environmental changes particularly temperature, photoperiod and food supply [4]. Fecundity and spawning habits are among the important aspects of the biology of fishes which must be understood to explain the variation of the level of population as well as to make efforts to increase the amount of fish harvest [5] and also determination of fecundity and the development of sexual maturity is a fundamental to fishery science [6].
The most suitable method of determining the reproductive cycle of fishes is to observe seasonal developmental changes in gonads [7, 2, 3]. This maturation cycle has been described as morphological changes that gonads undergo to attain full growth and ripeness [6]. The term fecundity can be expressed as the number of eggs laid in one season by the species. The egg production varies not only among different species but also within the same species depending upon the length and weight of gonad and influenced by the environment [8, 9]. No information available regarding the size at first maturity and maturity stages of *Terapon puta* with the view of supplementing this, the present study was undertaken along the Pondicherry coast

2. Materials and Methods
2.1 Size at first maturity (Lm_{50})
A total of 250 male and 235 female *Terapon puta* were collected from Nallavadu fish landing centre, Puducherry coast from July 2008 to June 2010. The size at first maturity was determined during the spawning season. The fishes were considered as immature when their maturity was in stages one and two. They were considered as mature when their maturity was in stage three [10]. The relation between length and maturity in size classes was demonstrated on a logistic diagram for estimating the total lengths at 50% maturity. To calculate the size at 50% maturity (Lm_{50}) of this fish, the gonads were classified according to the description of Pollard (1972).
Size at first maturity of *Terapon puta* was studied based on 32 male (12 to 20 cm in TL) and 163 female (12 to 22 cm in TL). The data were grouped into many size groups and the percentage compositions of matured specimens in each size group were also calculated.

Size at first maturity (Lm_{50}) is the length at which 50% of the fish have reached maturity. In the present study it was noticed that the 50% of observed sexual maturity of male and female fishes were in the matured stage. The large and whitish testis and yellowish orange ovaries are defined as matured. The GSI values of these matured gonads are found be high.

2.2 Maturity stages

The percentage composition of various maturity stages in different months was computed for two years. Male and female gonads of *Terapon puta* were categorized into five developmental stages based on the observations and their abundance. Stage-I (Immature); gonad size reduced, translucent, occupying very small portion of the body cavity. Stage-II (Maturing); gonads occupying one third of the abdominal cavity. Stage-III (Matured); gonads turgid, occupying the majority of the abdominal cavity (In female, the oocytes are visible to the naked eye, while in the male the testis are whitish). Subsequently stage-IV (Ripe); gonads occupying the entire length of the body cavity; ovaries distended and containing large translucent eggs and Stage-V (Spent); gonads completely flaccid.

3. Results

3.1. Size at first maturity (Lm_{50}) of *Terapon puta*

The logistic curves describing the relationship between sexes and the proportion of 50% maturity was estimated and attain at 16.4 cm in male whereas the female having 50% maturity was found at 16.7 cm (Fig.1 & 2). In support to these present findings the male reached at 50% first sexual maturity at smaller length than female.

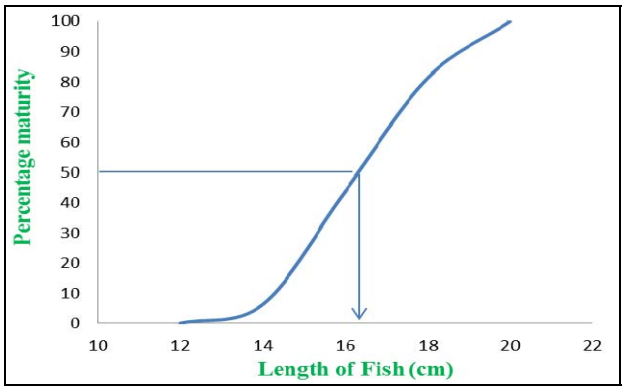

Fig 1: Relationship between percentage composition of proportion of maturity and size groups of male *Terapon puta* during July 2008 to June 2010

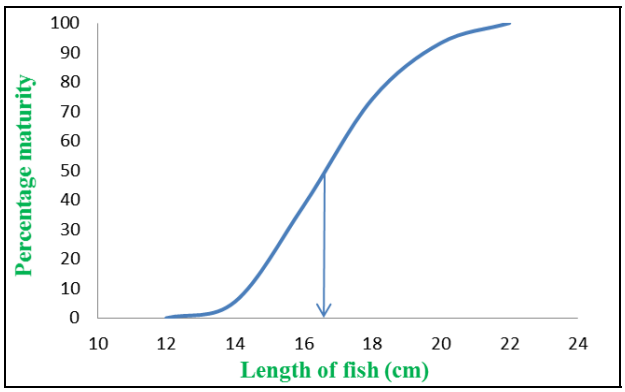

Fig 2: Relationship between percentage composition of proportion of maturity and size groups of female *Terapon puta* during July 2008 to June 2010

3.2. Maturity stages of *Terapon puta*

In male *Terapon puta*, stage-I (Immature) was recorded low during the month November (12.5%) and increased with peak in May (88.89%). Low percentage of stage-II (Maturing) was recorded in July (5%) and high percentage in June (69.23%). Stage-III (Matured) fishes were recorded low in October (14.29%) and peak level in September (63.64%). The percentage compositions of stage-IV (Ripe) were noticed low in the month of March (36.84%) and high during the month February (100%). Large percentage of stage-V (Spent/Resting) fishes was observed during the month of November (50%) (Fig. 3).

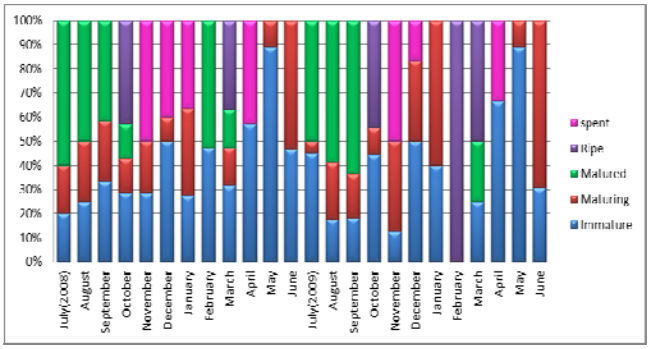

Fig 3: Maturity stages of male *Terapon puta*

In female *Terapon puta*, stage-I (Immature) was recorded low during the month January (9.09%) and peak in May (100%). Low percentage of stage-II (Maturing) was recorded in July (9.09%) and peak in January (100%). Stage-III (Matured) fishes were recorded low in October (7.14%) and peak level in July (72.73%). The percentage compositions of stage-IV (Ripe) were noticed low in the month of November (10%) and high during the month March (75%). Large percentage of stage-V (Spent/Resting) fishes was observed during the month of April (57.14%) (Fig. 4).

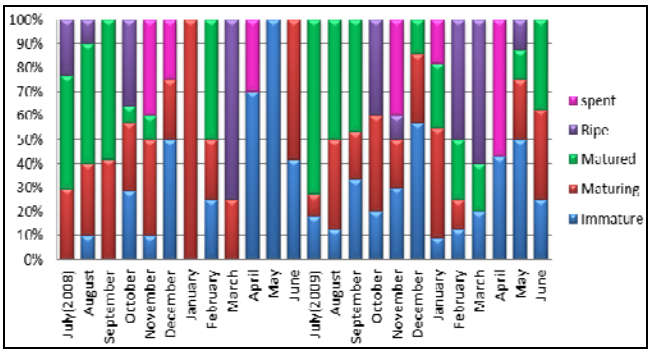

Fig 4: Maturity stages of female *Terapon puta*

4. Discussion

4.1 Size at first maturity (Lm_{50})

From the present study, the size at 50% maturity of *Terapon puta* is 16.4 cm for male and 16.7 cm for female. Lm_{50} is an important trait of life history necessary for success of fishery management, fundamental to establishment of the means that avoid exploitation of young specimens and consequential reduction of spawning stock [11]. It seems that there is also differentiation in maturity between the two sexes. Most of the male reached maturity smaller and younger than female which explains the greater duration of life of the female that mature later [12]. Brusle [13]. Has observed that there is a relationship between first sexual maturity and temperature in every region.

Hence, younger ages and smaller sizes at maturity are observed in warm waters, whereas in cooler waters, both age and size at maturity are higher. The logistic Curve Has Been Successfully Used to Estimate the Size At 50% Maturity for Some Species [14, 15]. Tormosova [16] Has Suggested That Stock Density, Food and water temperature may influence the growth of fish and further affecting the age at 50% maturity.

4.2 Maturity stages

The gonad development and reproductive strategy have been described in many teleost fish species in an effort to understand the time of course and energetic consequences of reproductive effort. Oocyte growth follows a similar general pattern in most of the Teleosts [17, 18]. However in the Present Study, there are Five Different Maturity Stages of Gonads Observed. Similar observations were made in *Gobioides rubicundus* and *Odontamblyopus rubicundus* (Hamilton, 1822) by Kader *et al.*, [19]. Furthermore, the fish that undergoes gonadal maturation during spawning periods of lower food availability utilize their somatic energy reserves. The fishes particularly need the rich protein content for reproductive growth [20, 21].

5. Conclusion

The present study has added information on the knowledge of length at maturity and seasonal development changes in the gonads of *Terapon puta*. The seasonal changes in the gonads help to study about the spawning season. The knowledge on length at maturity and spawning season detects when and at which length the fish should be protected and therefore it is important for the proper management and conservation of fish stocks.

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