



Size at first maturity and maturity stages of *Terapon jarbua* (Forsskal, 1775) from Pondicherry Coast, India

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Abstract

Size at first maturity of *Terapon jarbua* was studied based on 114 male (14 to 28 cm in TL) and 140 female (14 to 32 cm in TL). The Logistic curves describing the relationship between the sexes and the proportion of 50% maturity (Lm_{50}) were estimated at 20.8 cm in male and 21.8 cm in female of *Terapon jarbua*. 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 jarbua*; reproductive cycle; sexual maturity; Pondicherry coast

INTRODUCTION

Terapon jarbua belong to the family Teraponidae is a medium size food fish which inhabits the sea, backwater and estuaries in Pondicherry coast. They constitute a regular fishery throughout the year. It is a predator and a lepidophagous fish. It feed on small fishes in the littoral zone and scales of large fishes. No information available regarding the size at first maturity and maturity stages of *T. jarbua* with the view of supplementing this, the present study was undertaken along the Pondicherry coast.

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 (Hunter *et al.* 1992). The most suitable method of determining the reproductive cycle of fishes is to observe the seasonal development changes in their gonads (Karlou-Riga and Economidis 1996, 1997). The reproductive cycle of fishes is closely tied to the environmental changes particularly

temperature, photoperiod and food supply (Bagenal 1978). 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 (Das *et al.* 1989) and also determination of fecundity and the development of sexual maturity is a fundamental to fishery science (Brown *et al.* 2003).

The most suitable method of determining the reproductive cycle of fishes is to observe seasonal developmental changes in gonads (Sivakumaran 1991; Karlou-Riga and Economidis 1996, 1997). This maturation cycle has been described as morphological changes that gonads undergo to attain full growth and ripeness (Brown *et al.* 2003). 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 (Kulshrestha *et al.* 1990; Barmanh and Saikia 1995).

METHODOLOGY

Random monthly samples of *T. jarbua* were collected during July 2008 to June 2010 from Pondicherry coastal waters, Pondicherry Union Territory, South India (Figure 1). Fishes were held on ice until examination. For each species, sex, total length and stage of maturity were recorded for morphometric determinations. Size at first maturity of *T. jarbua* was studied based on 114 male (14 to 28 cm in TL) and 140 female (14 to 32 cm in TL). The data was grouped into many size groups and percentage compositions of the proportion of matured specimens in each size group were calculated.

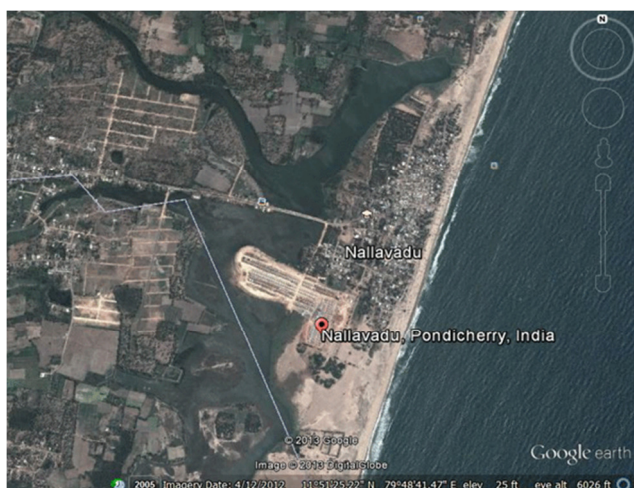


Figure 1: Map showing the study site (source: Google Map)

Size at first maturity ($L_{m_{50}}$): Size at first maturity ($L_{m_{50}}$) 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 in the matured stage. The large and whitish testis and yellowish orange ovaries are defined as matured and also the increased GSI values of gonads.

The size at first maturity was determined in the spawning season. When their maturity was in stages one and two, they were considered as immature, and those which were in stage three were considered as mature (Farmer *et al.* 2005). The relation between length and maturity in size classes was demonstrated on a logistic diagram for estimating the total lengths at 50% maturity. Concerning this fish to calculate the size at 50% maturity ($L_{m_{50}}$) of the proportion of mature fish, of which the gonads were observed by eye according to the description of Pollard (1972) was calculated in each body size class.

Maturity stages: The percentage composition of various

maturity stages in different months was computed for two years. Male and female gonads of *T. jarbua* were categorized into five developmental stages based on the gonad descriptions of *Cirrhina reba* Lower Anicut, Tamil Nadu (Mathiyalagan 2013). 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.

RESULTS

Size at first maturity ($L_{m_{50}}$) of *Terapon jarbua*

The logistic curves describing the relationship between sexes and the proportion of 50% maturity was estimated and attain at 20.8 cm in male whereas the female having 50% maturity was found at 21.8 cm (Figure 2 and 3). In support to these present findings the male reached at 50% first sexual maturity at smaller length than female. The size at maturity would be a useful index for determining the size of the exploitable stock.

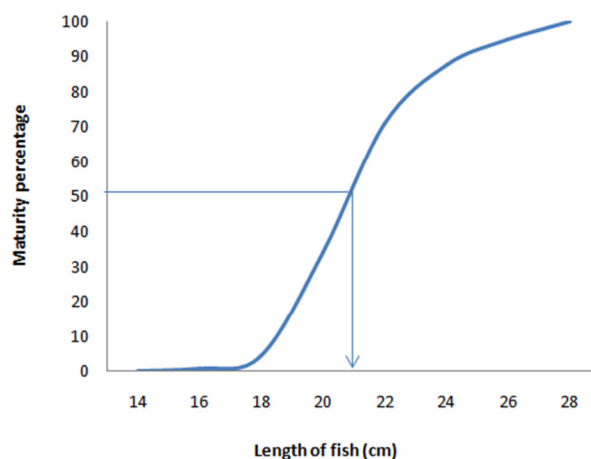


Figure 2: Relationship between percentage composition of proportion of maturity and size groups of male *Terapon jarbua* during July 2008 to June 2010

Maturity stages

In male *T. jarbua*, stage-I (immature) was recorded low during the month August (14.29%) and increased with peak in January (75%). Low percentage of stage-II (maturing) was recorded in the months March and July (10%) and high percentage in August (85.71%). Stage-III (matured) fishes were recorded low in May (8.33%) with peak level during the month March (100%).

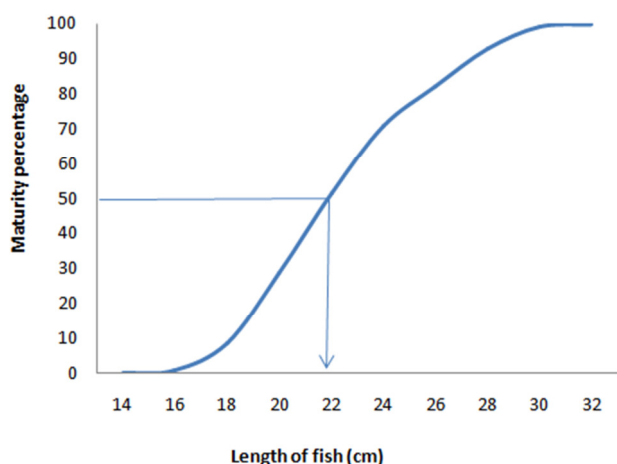


Figure 3: Relationship between percentage composition of proportion of maturity and size groups of female *Terapon jarbua* during July 2008 to June 2010

The percentage compositions of stage-IV (ripe) were noticed low in the month of December (6.67%) and high during the month April (100%). Large percentage of stage-V (spent/resting) fishes was observed during the month September (85.71%) (Figure 4).

In female *T. jarbua*, stage-I (immature) was recorded low during the month June (11.11%) and increased with peak in August (66.67%). Low percentage of stage-II (maturing) was recorded in April; (10%) and high percentage in the months October and November (100%). Stage-III (matured) fishes were encountered low in December (5.88%) with peak level during the months March and August (50%). The percentage compositions of stage-IV (ripe) were noticed low in the month of November (16.67%) and high during the months July and March (100%). Large percentage of stage-V (spent/resting) fishes was observed during the month September (50%) (Figure 5).

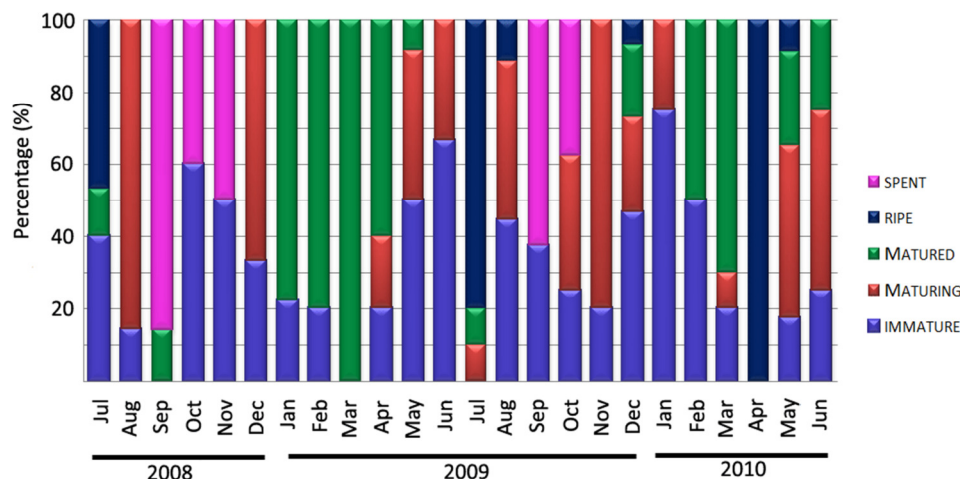


Figure 4: Maturity stages of male *Terapon jarbua*

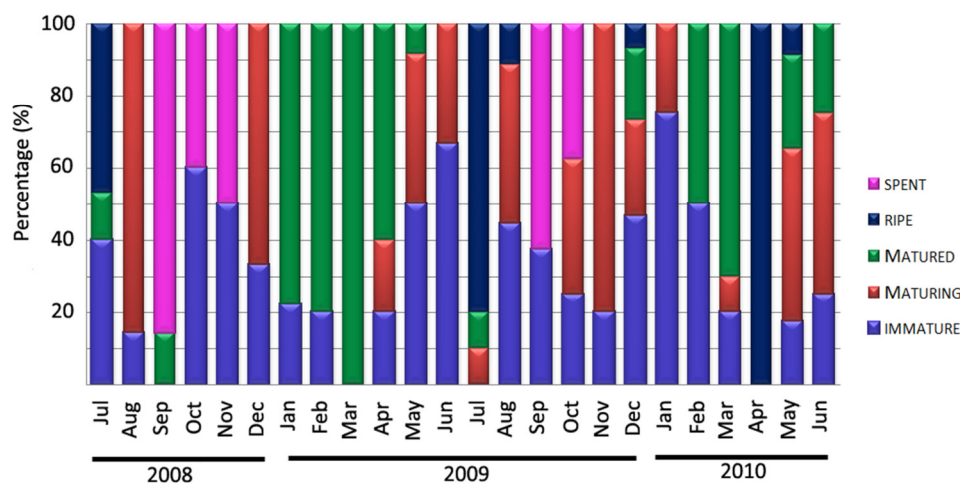


Figure 5: Maturity stages of female *Terapon jarbua*

DISCUSSION

Size at first maturity (L_{m50}): From the present study, the size at first maturity of *T. jarbua* is 20.8 for male and 21.8 for female. L_{m50} 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 (Penha and Mateus 2007). 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 (Nikolsky 1969). Brusle (1981) 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 (De Martini and Lau 1999; Liu *et al.* 2001). Tormosova (1983) suggested that stock density, food and water temperature may influence the growth of fish and further affecting the age at 50% maturity.

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 (Maddock and Burton 1999; Knuckey and Sivakumaran 2001). However the present investigation, there are five different maturity stages of gonads have been found in *T. jarbua*. Similar observations were made in *Gobioides rubicundus* and *Odontamblyopus rubicundus* (Hamilton, 1822) by Kader *et al.* (1988). More over the fish that undergoes gonadal maturation during spawning periods of lower food availability in most of the fishes are throughout to utilize somatic energy reserves, particularly the rich protein content to need for reproductive growth (Roff 1982; Sivakumaran *et al.* 2003).

CONCLUSION

The present study has added information on the knowledge of length at maturity and seasonal development changes in the gonads of *T. jarbua*. 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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REFERENCES

- Bagenal TB (1978) Aspects of fish fecundity, In: Gerking, SD (ed). Methods of Assessment of Ecology of Freshwater Fish Production. Blackwell, London, pp. 75-101.
- Barmanh R and Saikia SJ (1995) Length weight relationship and some ecological observations of *Cirrhinus reba* (ham) from wet lands of Assam, India. Environment and Ecology 13(3): 721-724.
- Brown P, Sivakumaran KP, Stoessel D, Giles A, Green C and Walker T (2003) Carp Population Biology in Victoria. Report No. 56, Marine and Freshwater Resources Institute, Department of Primary Industries, Snobs Creek, Victoria. p. 202.
- Brusle J (1981) Sexuality and biology of reproduction in grey mullets. In: Oren, O.H. (ed.) Aquaculture of grey mullets. International Biological Programme No. 26. Cambridge University Press, Cambridge. pp. 94-154.
- Das M, Dewan S and Debnath SC (1989) Studies on fecundity of *Heteropneustes fossilis* (Bloch) in a mini pond of Bangladesh Agricultural University, Mymensingh. Bangladesh Journal of Agricultural Sciences 16: 1-6.
- De Martini EE and Lau BB (1999) Morphometric criteria for estimating sexual maturity in two snappers, *Etelis carbunculus* and *Pristipomoides sieboldii*. Fishery Bulletin 97: 449-458.
- Farmer BM, French DJW, Potter IC, Hesp SA and Hall NG (2005) Determination of biological parameters for managing the fisheries for Mulloway and Silver Trevally in Western Australia. Centre for Fish and Fisheries Research Murdoch University, Murdoch Western Australia 6150, Fisheries Research and Development Corporation Report FRDC Project 2002/004, p. 150.
- Hunter JR, Macewicz BJ, Lo NCH and Kimbrell C A (1992) Fecundity, spawning and maturity of female Dover sole *Microstomus pacificu*, with an evaluation of assumption and precision. Fishery Bulletin 90: 101-128.
- Kader MA, Bhuiyan AL and Manzur-I-Khuda ARMM (1988) The reproductive biology of *Gobioides rubicundus* (Ham. Buch.) in the Karnaphuli estuary, Chittagong. Indian Journal of Fisheries: 35(4): 239-250.
- Karlou-Riga C and Economidis PS (1996) Ovarian atretic rates and sexual maturity of horse mackerel, *Trachurus trachurus* (L.), in the Saronikos Gulf (Greece). Fishery Bulletin 94: 66-76.

- Karlou-Riga C and Economidis PS (1997) Spawning frequency and batch fecundity of horse mackerel, *Trachurus trachurus* (L.), in the Saronikos Gulf (Greece). *Journal of Applied Ichthyology* 13: 97-104.
- Knuckey IA and Sivakumaran KP (2001) Reproductive characteristics and perrecruit analyses of blue warehou (*Seriolella brama*): implication for the south east fishery of Australia. *Marine Freshwater Research* 52: 545-587.
- Kulshrestha SK, Adholia UN, Bhatnagar A and Khan AA (1990) Length weight relationship *Wallago attu* (Schneider) with reference to certain environmental conditions from selected river of Madhya Pradesh and Rajasthan. *Environment and Ecology* 8(4): 1190-1194.
- Liu KM, Hung KY and Chen CT (2001) Reproductive biology of the big eye *Priacanthus macracanthus* in the northeastern waters off Taiwan. *Fisheries Science* 67: 1108-1114.
- Maddock DM and Burton MPM (1999) Gross and histological observations of ovarian development and related condition changes in American plaice. *Journal of Fish Biology* 53: 928-944.
- Mathialagan R (2013) Studies on the Molecular taxonomy and Biology of Reba carp *cirrhinus reba* (Hamilton, 1822) from Lower Anicut, Tamil Nadu, PhD Thesis, Bharathidasan University, Tamil Nadu.
- Nikolsky GV (1969) Theory of fish population dynamics as the biological background for rational exploitation and management of fishery resources, Oliver & Boyd, Edinburgh.
- Penha JMF and Mateus LAF (2007) Sustainable harvest of two large predatory Catfish in the Cuiabá river basin, northern Pantanal, Brazil. *Brazilian Journal of Biology* 67(1): 81-89.
- Roff DA (1982) Reproductive strategies in flatfish a first synthesis. *Canadian Journal of Fisheries and Aquatic Sciences* 39: 1686-1698.
- Sivakumaran KP (1991) Studies on the Biology and Population Identification of *Rastrelliger kanagurta* (Cuvier, 1817) (Pisces: Scombridae) from the Coastal Waters of India. Ph.D Thesis, Annamalai University, Porto-Novo. 250p.
- Sivakumaran KP, Brown P, Stoessel D and Giles A (2003) Maturation and reproductive biology of female wild carp, *Cyprinus carpio* in Victoria, Australia. *Environmental Biology of Fishes* 68: 321-332.
- Tormosova ID (1983) Variation in the age at maturity of the North Sea haddock, *Melanogrammus aeglefinus* (Gadidae). *Journal of Ichthyology* 23: 68-74.