Indian J. Fish., 61(4) : 128-130, 2014

Note

New record of the gaper *Champsodon nudivittis* (Ogilby, 1895) from the deep waters of north-east Arabian Sea with notes on its biology

U. GANGA, P. T. JINESH AND N. BENI

Central Marine Fisheries Research Institute, P. B. no. 1603, Ernakulam North P. O, Kochi - 682 018, Kerala, India
e-mail: ganga@cmfri.org.in

ABSTRACT

The gaper *Champsodon nudivittis* is reported as the first record of the species in the northern Arabian Sea where it was caught at 280 -390 m depths between 19 and 21^0 N latitudes. Study confirmed the presence of a sizeable self-regenerating population of *C. nudivittis* in the northern Arabian Sea comprising of reproductively active, mature fish, which was believed to be absent so far. The size range of the specimens caught was 55-105 mm with modal size 75-85 mm. Females were significantly dominant ($p<0.05$) in > 60 mm size groups, with a sex ratio of 1:4.3. Catch was dominated by mature females, with an estimated L_m of 74 mm. Mean absolute fecundity was 740±156 eggs and mean relative fecundity 205±97 eggs per gram body weight. It is a carnivorous predator, feeding on young of several commercially important fishery resources such as the pandalid shrimps, sergestid shrimps (*Acetes*) and the Indian codlet *Bregmaceros* spp. found in the northern Arabian Sea.

Keywords: Champsodontidae, Gaper, Northern Arabian Sea

Gapers or crocodile tooth fishes belonging to the family Champsodontidae are small mesopelagic fishes and 13 species of the genus *Champsodon* occur in the oceans worldwide. The species reported from the Indian Ocean are *C. capensis*, *C. omanensis, C. pantolepis,* and *C. sechellensis* (Nemeth, 1994) while *Champsodon nudivittis* has been recently reported in the Red Sea and Mediterranean (Çiçek and Bilecenoglu, 2009; Goren *et al*., 2011). The biological aspects of various species of *Champsodon* are poorly known as they do not form commercial fisheries. However, like other mesopelagics these fishes also exhibit daily vertical migrations and qualify both as predator and prey in the marine food web, there by facilitating the transfer of carbon from the deep sea to the surface and surface CO_2 to the lower realms (Morohoshi *et al*., 2003; Karuppasamy *et al*., 2010). During a recent exploratory survey for myctophids in the northern Arabian Sea, the catch included substantial numbers of gapers with the most abundant species in this sample being *C. nudivittis*, which has not so far been reported to occur in the region and hence the biology of this fish was studied in detail.

Samples were obtained during cruise 313 FORV *Sagar Sampada* from different locations at a depth range of 282 – 393 m in the north-east Arabian Sea, off Veraval (lat 19˚ to 21˚N). Individual fishes (n=312) caught in the net were measured for total length (mm) to obtain the size frequency distribution. Using 233 fishes which were undamaged, length-weight relationship was estimated as $W = aL^b$, where L is length (mm) and W is weight (g) of fishes while a and b are constants derived by regression method. The fishes were sorted sex-wise and further the female gonads were classified as immature or maturing/ripe, depending on their size relative to body cavity and the presence of eggs in the ovaries. Gonadosomatic index (GSI) of mature female fishes in this sample was estimated as: GSI = (GW/TW)*100, where GW represents the gonad weight and TW the total body weight. Absolute and relative (eggs per gram body weight) fecundity was estimated in eight ripe fishes with well developed oocytes (stage V and VI) measuring 78-97 mm size and weighing between 2 - 6.3 g each. Oocyte size measurements from the ripe ovaries were made using image analyser (Motic). L_m was estimated by the logistic curve method of King (2007) with fishes in stage III and above with distinct eggs in ovaries considered as mature. Sex ratio was assessed for three size classes assigned, such as 50-60 mm, 61-80 mm and > 81 mm taking into consideration the minimum length at which the species shows mature gonads

and compared using chi-square test. Feeding biology was studied following Hyslop (1980). The stomachs were assessed visually into 4 stages of fullness (empty, trace, half and full) and food items were identified to the genus/species level to the extent possible. Stomach with grading half and full were considered to be active feeding and rest as poor feeding. Occurrence method was used to determine preferred prey, including only stomachs (n = 106) which contained food. Percentage composition (by numbers and weight) of the various food items was also assessed.

Champsodon nudivittis was distinguished from other congeners based on following characters: chin, belly and the area between pectoral and pelvic fin bases naked, breast with only a small central patch of scales and the naked chin spotted with small melanophores; maxilla extending beyond posterior margin of eye and premaxilla with a distinct notch lateral to symphysis. Five to eight sensory papillae between the parallel bony ridges on dorsal surface of the head extending from snout to inter-orbital. The vertical rows of sensory papillae between the two horizontal lateral lines not closely surrounded by scales (Fig. 1). Meristic characters recorded were: dorsal fin spines 4, rays 20; anal fin rays 18; pectoral fin rays 13 - 14; ventral fin rays 6; first gill arch with 1 dorsal gillraker and 9-11 ventrally. One specimen each was deposited in the National Marine Biodiversity Referral museum of the Central Marine Fisheries Research Institute, Kochi (GB.31.133.2.1) and in the fish collection of Zoological Museum, Tel Aviv University (TAU P 15149). The species was reported only from the Indo-Pacific region namely in seas around Australia, Indonesia, Phillippines and Madgascar (Nemeth, 1994), recently from the Red Sea (Goren *et al*., 2011) and Mediterranean region (Çiçek and Bilecenoglu, 2009). The finding of *C. nudivittis* in the Red Sea and Mediterranean Sea has been considered a Lessepsian extension of distribution caused by the Suez canal (Goren *et al*., 2011) while Çiçek and Bilecenoglu (1999) regarded its presence in the eastern Mediterranean Sea but its absence in the Northern Arabian Sea as an indication of it being a ship - mediated invasive species. The present study however confirms the presence of a

Fig. 1. *Champsodon nudivittis* (SL 68 mm)

well-established self-regenerating population of *C. nudivittis* comprising of reproductively active, mature fish in the northern Arabian Sea which has not been reported earlier or was believed to be absent (Nemeth, 1994; Çiçek and Bilecenoglu, 1999). This observation is supported by the oceanographic studies which have indicated that there is mixing of the Indian Equatorial water mass found between the 200 -2000 m depth zone with Red Sea water resulting in the formation of a unique intermediate deep-water mass in the Arabian Sea (Jones, 1959; Varma *et al*., 1980) which probably results in larval /fish dispersal so that almost similar fish fauna occurs in these regions. Also, the study by Goren *et al*. (2011) concluded that several of the earlier reports prior to the taxonomic revision given by Nemeth (1994), that mention *C. omanensis* in the Red Sea are in fact *C. nudivittis*.

The size range of the specimens caught was 55 - 105 mm with modal size 75 - 85 mm. Among these, the length range of females was 62 - 105 mm and the males 54 - 102 mm. Length-weight relationship indicated no significant difference among sexes and was estimated commonly as $0.000006\ L^{3.0}$ (R^2=0.8149). Only males were recorded in the <60 mm size group while females were significantly dominant ($p<0.05$) in the > 60 mm size groups, with a sex ratio of 1:4.3. An overall abundance of females in the 200 - 400 m depth zone of the northern Arabian Sea from where they were caught was thus indicated. The females were mostly mature (88%) with the gonads carrying distinct eggs of 0.3 -0.6 mm dia. The GSI of ripe fishes was 11.9±4.0. Length at first maturity (L_m) in females was estimated as 74 mm. Maximum size the species attains is around 105 mm which indicates maturity is reached only when 70% of maximum size is attained, which is common in several slow growing, late maturing deep-sea fishes. The fact that nearly 88% of the fishes caught had maturing/mature gonads confirmed the presence of an established regenerating population of *C. nudivittis* in this region. The absolute fecundity of ripe females ranged from 530–983 eggs while relative fecundity was estimated as 98-317 eggs. Mean absolute fecundity was 740 ± 156 eggs and mean relative fecundity 205±97 eggs. Several species of other mesopelagic deep sea fishes also have low fecundity which indicates low natural mortality in larval stages (Salvanes and Kristoffersen, 2001).

Regarding intensity of feeding, 55% of the total fishes sampled had empty stomachs. Among the rest, active feeders formed 83% and poor feeding was seen only in 17%. Since fish move to upper layers mostly in relation to feeding in the DSL, it is observed that most of the fishes

with stomach contents recorded were in active feeding mode. Examination of the gut contents revealed a strongly carnivorous feeding habit with about six major prey items identified including pandalid and sergestid (*Acetes* spp.) shrimps as well as the fish *Bregmaceros* spp. According to percentage of occurrence, fishes were found in 31% and crustaceans in 83% of the stomachs containing food indicating a prey preference that could be related to the availability of pandalid and non-penaeid shrimps in the northern Arabian Sea (Deshmukh, 2003, Rajool Shanis *et al*., 2012) and indicates opportunistic feeding common in several deep sea fishes (Mauchline and Gordon, 1986). Percentage composition (by weight) of dominant food items present in the stomach was pandalid shrimps (25%), sergestids (24%), bregamacerotid fishes (26%), digested fishes/scales (24%) and occasionally detritus like matter (<1%). Although fishes were numerically less, their size was quite large agreeing with the observations of Morohoshi and Sasaki (2003) who reported intensive predation on bregamacerotids and other pelagic fishes in *Champsodon snyderi* with the prey often being 61 -101% of the predator standard length measurement. The prey found in the stomach analysis are reported to occur in the deep scattering layer (DSL) which is a dynamic and biologically very productive phenomenon in the deep sea, where several plankton and juvenile fishes congregate (Karuppasamy *et al*., 2011). It can therefore be concluded that mesopelagic fishes including *Champsodon* spp. observed in the DSL serve as an important link for energy transfer to the higher pelagic predators like tunas, sharks and billfishes.

Acknowledgements

Authors thank Dr. A. Gopalakrishnan, Director, CMFRI, Kochi for encouragement and for all facilities to carry out the research work. The financial support received from the Ministry of Earth Sciences, Govt. of India to conduct this research is acknowledged.

References

Çiçek, E. and Bilecenoglu, M. 2009. A new alien fish in the Mediterranean Sea: *Champsodon nudivittis* (Actinopterygii: Perciformes: Champsodontidae). *Acta Ichthyologica et Piscatoria*, 39 (1): 67 – 69.

Deshmukh, V. D. 2003. Non-penaeid shrimps. In: Mohan Joseph, M. and Jayaprakash, A. A. (Eds.), *Status of exploited marine fishery resources of India*, p.183-187.

Goren, M., Stern, N., Galil, B. S. and Diamant, A. 2011. On the occurrence of the Indo-Pacific *Champsodon nudivittis* (Ogilby, 1895) (Perciformes, Champsodontidae), from the Mediterranean coast of Israel and the presence of the species in the Red Sea. *Aquatic Invasions*, 6: 115-117.

Hyslop, E. J. 1980. Stomach contents analysis: a review of methods and their applications. *J. Fish Biol*., 17: 411 – 429.

Jones, M. 1959. Research vessel *Kalava* and co-operative oceanographic investigations in Indian waters. *J. Mar. Biol. Ass. India*, 1(1): 1-6.

King, M. 2007. *Fisheries biology, assessment and management*, 2nd edn., Blackwell publishing Ltd, 382 pp.

Karuppasamy, P. K., Muraleedharan, K. R., Dinesh Kumar P. K. and Nair, M. 2010. Distribution of the mesopelagic micronekton in the Arabian Sea during the winter monsoon. *Indian J. Mar. Sci*., 39(2): 227 – 237.

Mauchline, J. and Gordon, J. D. M. 1986. Foraging strategies of deep-sea fish. *Mar. Ecol. Prog. Ser*., 27: 227 -– 238.

Morohoshi, Y. and Sasaki, K. 2003. Intensive cannibalism and feeding on bregmacerotids in *Champsodon snyderi* (Champsodontidae): evidence for pelagic predation. *Ichthyol. Res*., 50: 387-390.

Nemeth, D. 1994. Systematics and distribution of the family Champsodontidae (Teleostei: Perciformes), with description of three new species. *Copeia*, (2): 347-371.

Rajool Shanis, C. P., Akhilesh, K. V., Hashim Manjeybrakath, Ganga, U. and Pillai, N. G. K. 2012. Shrimps of the family pandalidae (Caridea) from Indian waters with new distributional record of *Plesionika adensameri* (Balss, 1914). *J. Mar. Biol. Ass. India*, 54(1): 45 – 49.

Salvanes, A. G. V. and Kristoffersen, J. B. 2001. Mesopelagic fishes. In: Steele, J., Thorpe, S. A. and Turekian, K. K. (Eds.), *Encyclopedia of Ocean Science*, p. 239 - 245.

Varma, K. K., Das, V. K. and Gouveria, A. D. 1980. Thermohaline structure and water masses in the northern Arabian Sea during February to April. *Ind. J. Mar. Sci*., 9: 148 – 155.

Date of Receipt : 09.01.2014
Date of Acceptance : 20.05.2014