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Tuna drift gillnet fishery at Chennai, Tamil Nadu- an update

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Original Article

Abstract

The present study describes the status of multiday drift gillnet fishery for tuna from Chennai fishing harbour based on data for the years 2016 – 2017. The data is also compared with that during 1999-2006. Both the craft and gear increased in size with consequent extension of fishing grounds and increase in the number of days/ fishing trip. The size of the boats increased to 20-23 m OAL from 11-12 m OAL and weight of the gear from 1 to more than 6 t. Annual average catch increased to 8523 t during 2016-2017 from 595 t during 1999-2006. Average catch per unit effort was 8310 kg as against 730 kg during 1999-2006. Yellowfin tuna, *Thunnus albacares* and Skipjack tuna, *Katsuwonus pelamis* were the dominant species. The stock position of skipjack tuna and yellowfin tuna vis-à-vis the three indicators indicated that the percentage of mature yellowfin tuna in the catch in 2017 was 68%, fish in optimum length 35% and mega-spawners 33% whereas in skipjack tuna the respective percentages were 99.5, 21.1 and 79.1. Problems and prospects of multiday tuna drift gillnet fishery are also discussed.

***Keywords**: Tuna drift gill net, fishery, stock position, skipjack and yellowfin tuna.*

Introduction

Tunas and billfishes are epipelagic marine fishes that live primarily in the upper 200 m of the ocean and are widely distributed throughout the tropical, subtropical and temperate waters of the world's oceans (Collette and Nauen, 1983; Nakamura, 1985). All previous observations and studies indicate that there is considerable scope for augmenting tuna production, especially the untapped oceanic tunas (Sivaprakasam, 1995; Mitra, 1999; Pillai and Ganga, 2002; Abdussamad *et al.*, 2012). Of late, the Government of India is also aiming towards diversification of oceanic fishery resources especially tuna. In India, there is no organized fishing targeting oceanic tuna except in certain places. In Tamil Nadu, Chennai fishing harbour is an important center from where an organized tuna fishing employing multiday drift gillnet is practiced throughout the year. Chennai fishing harbour is also known as Kasimedu fishing harbour and Royapuram fishing harbour. Tuna fishing from here was largely from inshore waters till the year 2000. The first report on tuna fishery from Chennai was given by Srinivasarengan *et al.* (1994). Thereafter its status of exploitation in Chennai was presented by Kasim and Mohan (2009). The present study of tuna fishery in Chennai is to update the status of exploitation including changes in terms of craft and gear, extension of fishing ground, increase in the number of fishing days/trip, species composition, disposal etc. besides problems and prospects. The paper also attempts to apply the three indicators presented by Froese (2004) to investigate the stock position of skipjack tuna and yellowfin tuna exploited from Chennai.

Material and methods

Weekly data on species composition, size frequency and biology of dominant species of tunas for the years 2016 and 2017 were collected from the Chennai fishing harbour (Fig. 1). Catch from boats were directly transported to companies or agencies from where the tunas are taken to Kerala for further disposal. As these companies/agencies are situated near to the landing centre, the species composition and length measurements were taken at the time of unloading of catch here. Fork lengths were taken to the nearest 0.1 cm. Monthly and annual catch data of tuna from Chennai for the years 2016 and 2017 collected by the Fisheries Resource Assessment Division of ICAR-Central Marine Fisheries Research Institute, Kochi and maintained at the National Marine Fishery Data Centre was used to study the status of catch and catch per unit effort. The three indicators as given by Froese (2004) were applied to the annual size composition data of skipjack tuna and yellowfin tuna for the year 2017 to understand their stock position. The three indicators were:

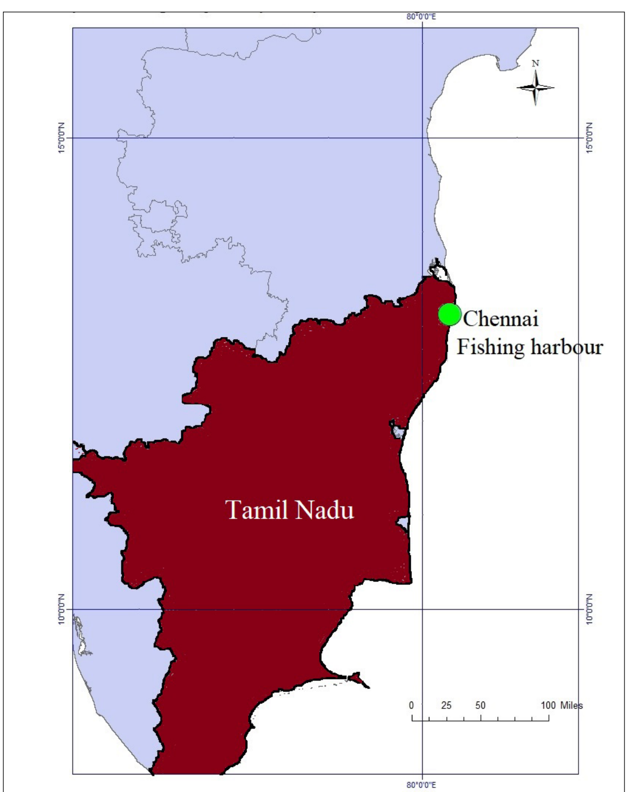

Fig. 1. Map showing Chennai Fishing Harbour

(1) percentage of mature fishes in the catch with 100% as target (ii) percent of specimens with optimum length in the catch, with 100% as target (iii) percentage of mega spawners in catch, with 0% as target and 30-40% as representative of reasonable stock structure if no upper size limit exists. The size at first maturity (L_m) for yellowfin tuna was taken from Abdussamad *et al.* (2012) and that of skipjack tuna from Koya *et al.* (2012). The optimum length (L_{opt}) was calculated based on the formula Log L_{opt} = 1.053*LogLm-0.0565 (Froese and Binohlan, 2000) based on the above values. The mega spawners were taken as percentage of fish of a size larger than optimum length plus 10% as suggested by Froese (2004). The percentage of mature fishes was taken as the percentage of fishes available from size at first maturity and above. The percentage of optimum length in the catch was taken as the percentage of fish present within ± 10% of optimum length.

Results

Fishery

Craft: Craft were wooden boats of 20 to 23 m OAL fitted with engines of 150 hp or less and with separate space for fish hold and storage of nets. (Fig. 2). The boats were fitted with mechanical winches to haul the net and provided with GPS and communication systems.

Fig. 2. A drift gillnetter

Gear: Drift gillnet of 120-140 mm mesh size was used. Each piece of net measured 180 m in length with width of 20 to 22 m. In a unit, 40 to 50 pieces were joined together to make a single net (Fig. 3). Head rope was provided with floats and foot rope with small weights. One plastic buoy was attached for every 3 m and after seven such buoys, one thermocol float was attached. One flag was attached after every 20 pieces of net. Each end of the net was provided with big thermocol floats into which battery operated lights that flicker throughout the day was fixed to mark the end of the net.

Fig. 3. Drift gill net

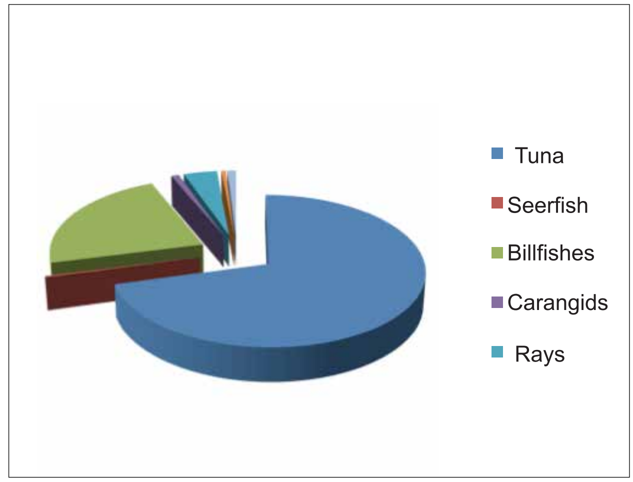

Fig. 4. Percentage composition of tuna in drift gill net fishery at Chennai

Man power: Man power varied from 8 to 11.

Operation: Immediately after reaching the ground, fishermen search for signs for occurrence of shoal. The main such indication is the availability of small fishes. Soaking of net start late in the afternoon. The net is released from one end and it takes nearly one to one and a half hour to complete the shooting of net. After around one hour, the net is lifted from one end to know the availability of the fishes. Once availability of fishes is ensured, the nets are lifted. Time taken for complete hauling of net was about 5 to 6 hours. The nets are operated only once/day but depending on the availability of shoal, the operation is extended to one more time. Next day, the net is operated in another ground. One fishing trip lasted for 5 to 20 days.

Fishing cost: Each fishing trip used around 800 to 1800 l of diesel. For preservation of fish, 120 -150 blocks of ice, each block weighing 150 kg were used. Besides, they also required 25 to 30 cans each of 25 l of freshwater for drinking, 30 to 35 cans of water for cooking and bathing, 1 or 2 numbers of gas cylinders and grocery items for cooking.

Fishing ground: Fishing ground varied during the study period. During June to September, fishing was carried out between off Nizampatnam and Kovalam near Chennai but may extend to off Nagapattinam also. During January to April, the fishing ground extend even up to near Andaman –Nicobar areas. But fishing was carried out entirely within the EEZ. During June-September, each fishing trip lasted from 5 to maximum 10 days. But during January-April, each fishing trip lasted 15 to 20 days as the fishing grounds were far off from the shore.

Landing: The average annual total landing by drift gillnet during 2016-17 was 12051 t. Tuna formed 70.7% (Fig. 4). The total tuna landings in 2016 and 2017 were 17045 and 5645 t respectively with an average of 8523 t.

Seasonal landing of tuna: The monthly landing showed maximum production in August. In general, July to September formed the most productive season followed by January to March (Fig. 5). In 2016, the fishing ban was during 15 April to 30 May. But in 2017, the ban extended to 61 days and thus ended on 14 June. In addition, there was voluntary suspension of fishing during October–December depending on the severity of north-east monsoon. So in effect, the fishing was only during 7 to 8 months.

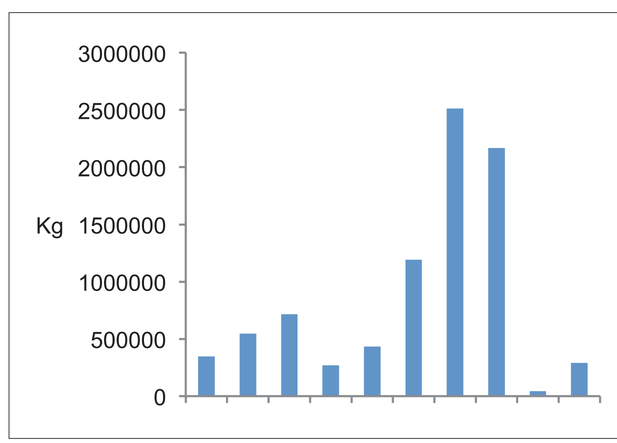

Fig. 5. Monthly landing of tuna by drift gill netters at Chennai

The annual catch per unit effort in 2016 and 2017 were 9336.7 kg and 6801.5 kg respectively with an average of 8310 kg.

Species composition: Tuna fishery was constituted by *Thunnus albacares* (29.2%), *Katsuwonus pelamis* (67.2%), *Euthynnus affinis* (1.7%), *Auxis* spp (1.6%), and others 0.3% (Fig. 6). Among these, the first two species occurred in the fishery throughout the year (Fig. 7).

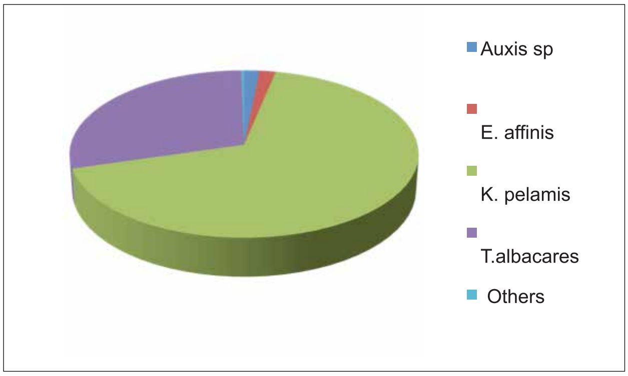

Fig. 6. Species composition of tuna by drift gillnetter at Chennai

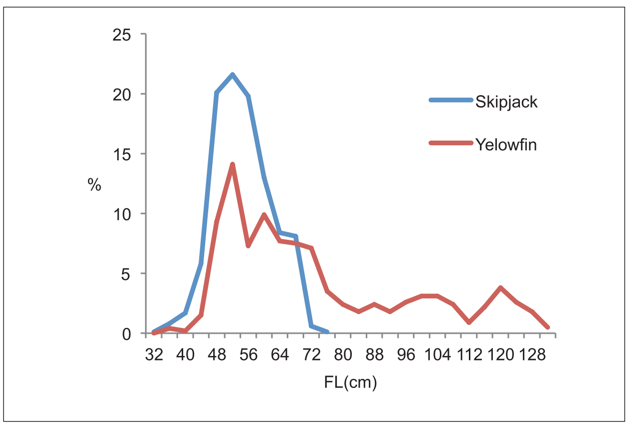

Fig. 7. Size composition of *K. pelamis* and *T. albacares*

Size composition: The fork length in *K. pelamis* ranged from 32 to 76 cm and that of *T. albacares* from 36 to 132 cm (Fig. 7). The length composition indicated domination of adults in *K. pelamis* whereas in *T. albacares*, the domination was from 48 to 72 cm.

By-catch: By-catch was mainly billfishes, mobulid rays, sharks, carangids etc. Out of the annual average gillnet catch during 2016-2017, billfishes formed 22%, mobulid rays 3.9%, sharks 0.5% and carangids 0.9% . Billfishes were mainly comprised by sailfish, black marlin and swordfish of which the first two were the dominant ones. Mobulid ray was mainly comprised by *Mobula japonica*. Sharks were of different species but there was no regularity in its landing or dominance of any particular species. Carangids were comprised by *Scombroide*s spp, and *Elacates bipinnulata* mainly. Billfishes were generally entangled and not gilled.

Disposal: Public auction of the landing was rare. There were three companies to which the boats sold their catch. Usually the boat owners get an advance amount from any of these companies with the explicit understanding that they would sell their catch of skipjack tuna, yellowfin tuna and kawakawa to the respective company. Other fishes including billfishes could be sold to anybody. This advance amount could be called as a caution deposit or a catch guarantee. The amount given varied from ₹6 to ₹7 lakhs per boat and it was given through bank cheque. Every year, the company would deduct ₹25000/- from the catch proceeds and by any chance, in a year if there was no fishing operation, then they would deduct proportionate amount in the succeeding year of fishing operation. If the boat owners decided to cease association with the company, the boat owners would have to return the balance amount owed from the caution deposit. If the boat was lost or damaged beyond repair due to some mishap, then the company would have to forgo the amount. If there arose any difference of opinion in settlement of caution deposit between the fishermen and the company, this would be resolved through the mediation of Chennai drift gillnet boat owners' Association. The price per kilogram of fish according to species of tunas was fixed in consultation with the boat owners in the beginning of a month. The main criteria for fixing the price were demand, availability and abundance of the resource etc. Once the rate was fixed, it was normally applicable for the whole month and might extend to the succeeding months also. The catches are unloaded and brought to the company through tricycles and the charges for this are met by the company. These are registered companies directly involved in collection, and export of tuna to different countries in addition to local distribution.

Sharing of the income: There were two types of sharing. In majority of the boats, out of the total proceeds, 56% was given to the owner, 12% to the driver, 26% to the crew and 6% to the helpers. From this 56% , the owner had to meet the operating cost like fuel charge, cost of ice, water, food items etc. In the other system, of the total proceeds 5% was given to the driver and 6% to the helpers. Then after deducting the operating cost, 50% of the income was given to the owner and 50% to the crew. The share given to the crew was divided equally among all including the driver with the driver getting two shares in addition to the 5% he already got while dividing the total income. The helpers of the boat are locally known as 'marathadikar' who fetch water, load ice, fuel, unload the catch, and clean the boat when the boat is at the harbour.

Stock position vis-à-vis indicators

Yellowfin tuna: The percentage of mature fish in the catch in 2017 was 68% and that in optimum length was 35% . The percentage of mega-spawners was 33% (Fig. 8).

Skipjack tuna: The percentage of mature fish in the catch in 2017 was 99.5% and that of fish in optimum length was 21% . The percentage of mega-spawners was 79% (Fig. 8).

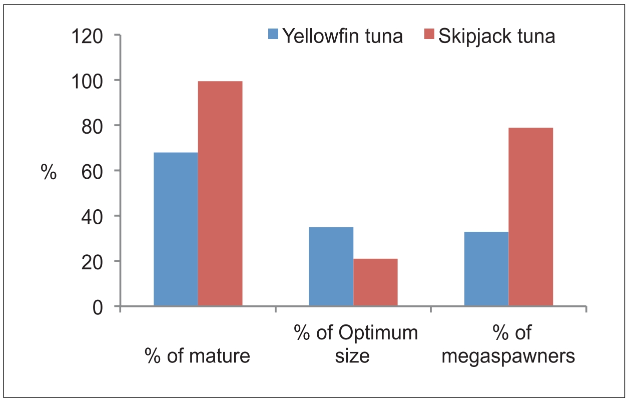

Fig. 8. Percentages of mature, optimum size and megaspawners of skipjack and yellowfin tuna.

Discussion

In Tamil Nadu, the total tuna catch varied from 1336 t in 1985 to 10912 t in 2006 with an average catch of 5000 t. During 2015 and 2016, it was 15885 and 20554 t respectively. Average production of tuna by mechanized gill netters at Chennai during 1981-1986 was 25 t (Srinivasarengan *et al.*, 1994). It increased to 595 t during 1999-2006 (Kasim and Mohan, 2009). The annual average catch during 2016 and 2017 was 8523 t. The present catch per unit effort also showed substantial increase with an average CPUE of 8310.8 kg. The annual average catch rate was only 444.9 kg during 1999-2006 (Kasim and Mohan, 2009). The increase in the landing as well as CPUE at Chennai was mainly due to the improvement in the craft and gear, increase in the number of boats besides extension of fishing ground and increase in the days of a fishing trip. According to the fishermen, prior to 2004, the boats were of 11-12 m OAL with nets weighing around 1 t. The duration of a fishing trip was 3 days. But after tsunami, the size of the boats was increased to 15–16 m OAL with nets weighing 3 t. Duration of a fishing trip was 5 to 6 days. Now the size of boats increased to 20 to 23 m OAL with nets weighing more than 6 t. The duration of a fishing trip went up to 20 days. This was mostly during lean period when they had to move towards far off grounds. The present study points out the need to publish details of craft and gear, addition of new technology and operation in addition to catch and effort so that future studies can compare and conclude the changes in the fishery. Earlier the tuna grounds were in the 10 –50 m depth zone (Kasim and Mohan, 2009). But now grounds are deeper where the depth exceed 1000 m within our EEZ.

Problems in the present tuna fishery was also evident. Manpower in most of the boats are from states other than Tamil Nadu or districts other than Chennai. The captain of the vessel was mostly from Tharuvaikulam, Tuticorin where this mode of fishing has been in vogue and fishermen were mostly from Andhra Pradesh. When the captain or workers leave for their native villages to attend local festivals or other matters, fishing operation were suspended till their return. Even though the present system of selling the catch to the companies has certain advantages like tension free disposal, prompt payment etc, lack of competitive auctioning reduced the margin of profit. But the competitive auctioning has also some disadvantages. In a place where all the catch is sold through public auction, it should be brought to the auction hall at the time of auction itself. Otherwise disposal of catch will be a great problem. Mostly, in the absence of merchants at the time of auction others may purchase the fish at a much lower rate than the usual general auction rate. Moreover, if catch is good and if more boats arrive than usual, then fishes at the beginning of auction will get higher rates and as catches continue to arrive, the rate per kilogram come down drastically resulting in heavy loss to the fishermen. But in Chennai, if the situation warrants, the company will purchase the catch throughout the day at the same rate per kilogram that is in force during that month. Moreover, the company would pay the persons who brought the tuna from the boat through tricycles. The size composition of yellowfin tuna landed in drift gillnet was normally dominated by sizes below 5 to 6 kg because of selective nature of the gear. Sizes above 20 kg weight were nominal. More importantly, quite often, tunas landed by multiday drift gill netters were in such a deteriorated condition that it fetched only 0.6% of the price of international market as observed by Shaukat Hussain (2017). Lack of proper preservation system on-board and retention of the net with entangled/gilled fish in water for longer periods have great contribution towards its spoilage. Proper preservation system and shorter retention time of the entangled/gilled fish may reduce this problem to a great extent. However, there is a major criticism against drift gillnet other than the quality of fish is the ability of the gear to entangle non-targeted species including marine mammals and turtles during fishing operation. According to Lecomte *et al.* (2018) the fishing gear with the greatest ecosystem impact is the gillnet, that are responsible for the largest volumes of bycatch. In addition, gillnets have a significant impact on ecologically important species such as cetaceans (dolphins and whales), sharks and turtles. These species generally die of suffocation before the net is raised, so it is not possible to release them alive. Gillnets are also responsible for the majority of catches of black marlin and blue marlin, the stocks of which are overfished and overexploited (IOTC-SC19, 2016). In Chennai, the black marlin landed by drift gillnetters mostly ranged from 1 to 3 numbers per boat and its landings were also not observed throughout the season. Tuna long liners with on-board preservation/freezing facilities may to a great extent improve the quality of the landed fishes and also reduce the catch of non-targeted species and marine mammals. Another advantage with tuna long liners is that it can land tunas of larger sizes which are not landed by drift gillnetters. Yellowfin tuna fishing using trolling and long line is being practiced successfully at depths of 200 m by traditional fishermen from Visakhapatnam since 2002 (Rohit and Rammohan, 2009). Notwithstanding these, the Chennai fishermen are not still convinced of the economic viability of tuna long liners. So before advocating its adoption, the government may take necessary steps to convince the success as well as advantage of this fishing method. Until then, the drift gillnet fishing will be the preferred one.

Here there was no targeted fishery for juvenile fishes of skipjack tuna or yellowfin tuna. High percentage of both mature Skipjack tuna (99.5%) and mega spawners (79%) were observed here. Since there was no fishing strategy in place that insisted on 0% mega spawners in the catch, the present size composition reflected a healthy condition. In the case of yellowfin tuna, the maximum recorded fork length was 240 cm and the common maximum fork length was 180 cm (IOTC, 2013). In the present fishery, the maximum fork length was 144 cm which was very much below the recorded maximum lengths. Moreover, in the fishery, length groups above 104 cm FL was nominal and their landing was sporadic. The percentage of mature fish (68%) and mega spawners (33%) indicate that the present fishing was not impacting the resource adversely. The present study on the three indicators was based on only one year's data. Hence further study using time series data may provide a better picture on stock position.

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