Conversion of mini trawls (Thallumadi) into light fishing craft targeting belonids and hemiramphids along palk bay, southeast coast of India

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Abstract
The needlefish both full beak and halfbeaks support a good fishery in Tamil Nadu and exploited by drift gillnet (Mural valai). In this study, we were focused to document the conversion of Mini trawls (Thallumadi) into light fishing craft targeting Belonids and Hemiramphids along Palk Bay. The detailed survey was conducted in the six landing centres along Palk Bay. The fishing was mainly targeted to catch Tylosurus crocodilus from 2000 to 0300 hrs at the distance of 3-4 NM in the depth of 5 m. After reaching the fishing ground, the fishes are usually aggregated using LED lights. The fishermen use the scoop net to collect the fishes. Catch per unit effort (CPUE) ranged from 36 to 40 kg/Unit and the fishery was dominated by T. crocodilus (85%) followed by Hemiramphus far (9%) and Ablennes hians (6%). The net operating income for this fishery is higher than the mini trawl fishery.

Keywords: needlefish, fishery, light, Tamil Nadu, catch per unit effort

1. Introduction
The Palk Bay is located between Tamil Nadu (India) and Sri Lanka along the Indian coast covering five coastal districts in Tamil Nadu viz., Ramanathapuram, Pudukottai, Thanjavur, Thiruvurur and Nagapattinam. The Palk Bay remains calm during most of the months. Turbulent conditions prevail during northeast monsoon period and fresh water streams dilute the sea near Mandapam. The coastline of Palk Bay has coral reefs, mangroves, lagoons, and sea grass ecosystems. The fishing season starts in October and lasts till February. Peak fishing season is during December to January [1]. The needlefish both full beak and halfbeaks support a good fishery in Tamil Nadu and on an average 42.6% of this resource in India is landed in Tamil Nadu [2]. These resources were exclusively exploited by a particular type of drift gill net locally known as ‘Mural valai’ along the Tamil Nadu coast. In this region, the commercially important species under the family Belonidae are Tylosurus crocodilus, T. acus melanotus, Strongylura leiura, S. strongylura, Ablennes hians and Platydolone argalus platyura and Hemiramphus far and H. lutkei are the two species under the family Hemiramphidae [3]. In general, the Needlefishes are phototactic and at night they are attracted by any lights [4]. The aggregation of fish in response to artificial lights was known from ancient times and this has led to the development of fishing with light in many parts of the world and exists in many forms. Light is being used in fishing by beach seine, Gill net, purse seine, lift net, drift net, scoop net, hooks and line and trap. The important among them are surrounding nets (purse seine), lift nets and hand lines. Apart from lights generated from kerosene pressure, gas and electricity, underwater lamps are also commonly in use. The major groups of fishes which possess light attraction response are sardines, mackerel, anchovies, carangids and squids [5]. Fishermen of Devipattinam fishing village started using light for fishing during September 2020 and soon this practice spread to the nearby fishing village of Palk Bay due to their profitability. This study has documented the light fishing for Belonids and Hemiramphids along the coastal stretch of 100 km from Devipattinam to Sethubhavachatram in Palk Bay during the 2020 lockdown period by converting the existing Mini trawls (Thallumadi) into a light fishing craft.

~ 163 ~
2. Materials and Methods
The light fishing was observed in the following fishing villages viz., Devipattinam (9.481178 78.89821), Thiruppalaikudi (9.544312, 78.91885), Soliyakudi (9.712552, 78.99778), Thondi Pudukudi (9.742539 79.02171), Karankuda (10.235, 79.26994) and Sethubavachatram (10.24741, 79.28123) from September to December 2020 (Fig.1). The detailed fishery information was collected from the fishers and discussed here. The fish was identified with FAO sheets \[6\]. The economic analysis was performed by following Geetha \textit{et al.} \[7\].

![Fig 1: Prevalence of light fishing along the Palk Bay coast of Tamil Nadu](image1)

3. Results
3.1 Craft and gear
The fishing was mainly targeted to catch \(T\.crocodilus\) (locally called \textit{Kalinga mural}). The Minitrawl (Fibre Reinforced Plastic) is converted and fitted with lights to target the needle fishes. Totally 3-5 persons are involved per fishing boat for this practice. FRB boats with OAL of 10.5 to 11.0 m fitted with18 hp outboard engines in Devipattinam, Thiruppalaikudi, Soliyakudi, Thondi and Pudukudi of Ramanathapuram district and 9-10 hp engines in Karankuda and Sethubavachatram of Thanjavur district were observed to practice this fishing method. Two different kinds of the light fishing method were employed by these two district fishermen in a mixed way viz., three focus LED lamps (200 W) and three LED bulbs (60 W) with the help of a 160 AH battery used for lighting (Fig. 2) which accounts 80 percent and 20 percent of the fishermen are using 0.5 kV generator as a power source for six focus LED lamps (200 W) and six LED bulbs (60 W) (Fig.3). The lights are fitted in starboard port sides and bow of the boat. The scoop net is made locally with a mesh size of 20-30 mm and the diameter varies from 50-55 cm. The width and length of the scoop net bag is 113 cm and 90 cm respectively.

![Fig 2: Lights arrangements for battery-powered FRP Craft](image2)
3.2 Fishing operations
The fishing was carried out from 2000 to 0300 hrs at a distance of 3-4 NM in the depth of 5 m. After reaching the fishing ground, the LED lights are switched on focusing the surface of the water using the power source for the fish to aggregate. The fishermen use the scoop net (locally called Arichavalai) to collect the fishes (Fig. 4). The fishing operation is generally continued for 5 hours without anchoring the boats with the lights switched on throughout.

3.3 Catch per unit effort (CPUE)
During the initial days, the catch was good and the CPUE ranged from 36 to 40 kg/Unit and as time goes by there is a decreasing trend in the CPUE was observed ranged from 10 to 12 kg/unit. The catch rate depends on the aggregation of fish in response to light. The number of units operated in the fishing villages shown in figure 5.

![Fig 3: Lights arrangements for generator powered FRP Craft](image)
![Fig 4: Scoop net used for light fishing](image)
![Fig 5: Number of units involved in light fishing along the Palk Bay coast](image)
3.4 Catch composition

The fishery was dominated by *T. crocodilus* (85%), *H. far* (9%) and *A. hians* (6%) (Fig. 6). The size range of *T. crocodilus* (Fig.7), *H. Far* (Fig.8) and *A. hians* is 80-100 cm, 24-30 cm and 60-90 cm respectively. The fish are sold at an average rate of ₹250-300 per kg.

![Catch composition diagram](image)

**Fig 6**: Species composition of fish in light fishing

![Kalinga mural or Pachai mural (*Tylosurus crocodilus*)](image)

**Fig 7**: Kalinga mural or Pachai mural (*Tylosurus crocodilus*)

![Selva mural (*Hemirampus far*)](image)

**Fig 8**: Selva mural (*Hemirampus far*)
3.5 Limitations
1. Heavy wind and wave action reduce the fish catch in light fishing
2. Phototaxis behaviour of the fish

Economics analysis of FRP Craft fishing with lights per trip (values in ₹)

| Particulars          | Battery | Generator |
|----------------------|---------|-----------|
| i. Initial investment| 20000.00| 20000.00  |
| ii. Battery/Generator 0.5 kVA | 2000.00 | 3500.00   |
| iii. Gear and accessories | 50.00   | 500.00    |
| iv. Lights            | 3000.00 | 10000.00  |
| Total                | 223500.00| 245500.00 |

2. Fixed cost

a. Depreciation
   - Craft and engine (20%) : 250.00
   - Battery/Generator (10%) : 16.60
b. Interest on investment : 130.37
   - 143.20

c. Repair and maintenance : 41.60
   - 66.60

Total : 438.57
   - 488.96

3. Operating cost

i. Fuel : 300.00
   - 1000.00
ii. Crew wages : 3000.00
   - 4500.00
iii. Food : 200.00
   - 300.00

Total : 3500.00
   - 5800.00

4. Total cost (2+3) : 3938.57
   - 6288.96

5. Gross Revenue : 9000.00
   - 13500.00

6. Net operating income (5-3) : 5500.00
   - 7700.00

7. Net profit (5-4) : 5061.43
   - 7211.04

8. Total (profit margin (7/5)*100) % : 56.23
   - 53.41

9. Annual days of operation : 120

10. Productivity measures
   - Labour productivity (kg) : 15.0
   - 15.5
   - Remuneration (Rs.) : 1687.14
   - 1802.76
   - Fuel efficiency (kg/L) : 8.0
   - 3.6

4. Discussion
Fishing using lights has been practised by a man from historic times, and continues throughout the history of fishing. A classic example from India ismore than 200-years old. Chinese dip nets (stationary lift nets) in Kerala, use lights (earlier kerosene lights and now CFL lamps) to attract fish over the dipnet [8]. Japan is one of the main nations in the world which practices light fishing [9]. Technological intervention in the Indian fishing industry is intended to increase marine fish production of the country. Beloniform fishes are dominant and they are caught selectively in different type of gill nets along Thoothukudi coast. They were reported five species of Halfbeaks belongs to the family Hemirhamphidae and six species of full beaks belongs to family Belonidae [10]. In palk bay also the needle fishes were targeted and exploited with selective gears called Mural valai. The use of lights designed for fishing was limited earlier, and mostly confined to squid fishing boats (squid jigger) along the coast. Reduction in the quantity of catch per unit effort on one hand and increasing cost of fishing inputs on the other hand, the investment in capital intensive fishing units have become risky [10]. It is mainly due to continuous increase in the price of fishes that the fishing units are able to earn moderate profits. Light fishing is one of the innovative cost effective and efficient techniques used by fishermen of Palk Bay yielded more catch of needle fishes than that of gill netting. Analysis of economics of both battery and generated operated light fishing units indicated that almost on an average, run on profit. However, due to the nature of competition of open access marine fisheries, sometimes the less efficient units belonging to each category are being phased out of operation due to losses [7].

Earlier studies indicate that most of the large pelagic predatory fishes (carangids, tunasand barracuda) that are caught in purse-seines with lights are above their sizes-at-first-maturity, [8] and the present study also has found similar results. In India, in many places light fishing has led to conflicts among traditional fishers who exploit different resources in territorial waters using traditional gears. Targeted fishing, no damage to juveniles, less labour dexterity, high fuel efficiency and marginal engine depreciation lead to sustainable fishing when compared to Mini trawls. However, on a precautionary measure, this new fishing practice needs to be studied in detail to understand its long term effects on the sustainability and suitability along this coast.

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6. References
1. Kumaraguru AK, Joseph VE, Rajee M, Balasubramanian T. Palk Bay information and bibliography 2008, 234.
2. Kayalvizhi E, Jayakumar N, Jawahar P, Sirinivasan A. Checklist of beloniform fishes of coastal waters of Thoothukudi, southeast coast of India. J Entomol Zool Stud 2018;6(6):306-309.
3. Joshi KK, Sreeram MP, Zacharia PU, Abdussamad EM, Varghese M, Habeeb Mohammed OM et al. Check list of fishes of the Gulf of Mannar ecosystem, Tamil Nadu, India. Journal of the Marine Biological Association of India 2016;58(1):34-54.
4. He D. Studies on physiology of phototaxis of fish and marine animals in china. In Fish Physiology, Fish Toxicology, and Fisheries Management: Proceedings of an International Symposium, Guangzhou, PRC, September 14-16, Environmental Research Laboratory, Office of Research and Development, US Environmental Protection Agency 1988, 1990, 208p.
5. Achari RB, Joel JJ, Gopakumar G, Philipose KK, Thomas KT, Velayudhan AK. Some observations on light fishing off Thiruvananthapuram coast. Marine Fisheries Information Service, Technical and Extension Series 1998;152:9-12.
6. Fischer W, Bianchi G. FAO species identification sheets for fishery purposes: Western Indian Ocean (Fishing Area 51). 1984, 5(1).
7. Geetha R, Narayanakumar R, Shyam SS, Aswathy N, Chandrasekhar S, Sirinivasa Raghavan V et al. Economic efficiency of mechanised fishing in Tamil Nadu: A case study in Chennai. Indian Journal of Fisheries 2014;61(1):31-5.
8. Mohamed KS. Fishing Using Lights How should India handle this new development. Marine Fisheries Policy Brief-4 2016;4:1-8.
9. Lorient F. Report of the ICES-FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB).
10. Narayanakumar R, Sathidhas R. Techno-economic efficiency of resource use in trawl fishing in Andhra Pradesh: A case study in Kakinada. In: Seventh Indian Fisheries Forum 2005, 8-12 November, Bangalore 2005, 367-375.