Exploring gear-vessel catch efficiency of frigate tuna (*Auxis thazard*) in tuna fishery of Sri Lanka

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Abstract

Tuna is the most important commercial fish group in the marine fishery in Sri Lanka. Within the tuna group, the subgroup of neritic tuna, comprising *Auxis thazard* (frigate tuna), *Auxis rochei* (bullet tuna), *Euthynnis affinis* (kawakawa) and *Scomberomorus commerson* (narrow- barred Spanish mackerel), is also an important contributor in the marine fish production. Among the four key species of neritic tuna found in Sri Lankan waters, frigate tuna is the dominant species presently contributing over 40% of the total neritic tuna production. Frigate tuna is normally caught as a by-catch in the tuna fishery. Ten year port sampling data of Sri Lanka (2005-2014) was used to explore the gear-vessel catch efficiency of frigate tuna in the tuna fishery of Sri Lanka. Four single gears (gillnet, pole & line, ringnet and trolling line) and three gear combinations (gillnet-handline, gillnet-ringnet, longline-gillnet) mainly contributed for catching frigate tuna. However, only 14% of tuna vessels operated during this period with above gears brought frigate tuna. Based on port sampling data, the estimated probability of presence of frigate tuna on a given fishing boat (p) greatly varies among above gears/ gear combinations. Accordingly, the highest probability (p=0.36) was reported for boats operated with ringnets whereas the lowest probability (p=0.08) was reported for boats operated with gillnet-longline gear combination. In terms of operated vessels in the tuna fishery, a lower probability of presence of frigate tuna on a given fishing boat was reported for two types of boat categories which are operated in shallow coastal waters (UN2A (p=0.04) & UN1 (p=0.01)) and the boats operate mostly at high seas (UN3B (p=0.05)). A higher probability of presence of frigate tuna on the fishing boat was reported for two boat categories (UN2B (p=0.22) and UN3A (p=0.15)) which are mostly operated in the continental slope and bordering areas of offshore. The average non-zero catch rates in terms of frigate tuna catch in terms of kg per boat per day is higher for single day fishing boats operated in coastal waters than the multiday fishing boats. The study

concluded that ringnet is the most efficient fishing gear used in Sri Lanka for catching frigate tuna.

1. Introduction

The neritic tuna is one of the important contributors in the tuna fish production of Sri Lanka since it contributes more than 10% of the total landings of tuna and tuna like species (Haputhantri and Bandaranayake, 2013). Basically, four species of neritic tuna are frequently found in Sri Lankan waters: *Auxis thazard* (frigate tuna), *Auxis rochei* (bullet tuna), *Euthynnis affinis* (kawakawa) and *Scomberomorus commerson* (narrow- barred Spanish mackerel). The key species reported in the neritic tuna catch is frigate tuna. This species presently contributes over 40% of the total neritic tuna production (PELAGOS, 2014). Frigate tuna is normally caught as a by-catch in the tuna fishery. A range of gear and vessels operates in the tuna fishery of Sri Lanka.

The fisheries data relating to tuna and tuna-like species are basically provided to Indian Ocean Tuna Commission (IOTC) through a port sampling scheme launched by the National Aquatic Resources Research and Development Agency (NARA), Sri Lanka. At present, both NARA and Department of Fisheries and Aquatic Resources (DFAR) are jointly engaged in port sampling data collection. Under the present study, it was attempted to explore the gear-vessel catch efficiency of frigate tuna in the tuna fishery of Sri Lanka. Ten year port sampling data (2005-2014) was used for this audit.

2. Classifying fishing crafts and gear operating in the tuna fishery contributing to catch frigate tuna

Though a wide range of vessels and gear are operated in the tuna fishery, some of them do not significantly contribute to catch frigate tuna. Four single gears (gillnet (GN), pole & line (PL), ringnet (RN) and trolling line (TL)) and three gear combinations (gillnet-handline (GH), gillnet-ringnet (GR), longline-gillnet (LG)) were identified as the key gear / gear combinations contributing for catching of frigate tuna. The following classification of single day and multiday fishing vessels gives some idea about the main types of vessels operating at present in the tuna fishery of Sri Lanka with a description of vessels (Table 1).

Table 1 Classification of single day and multiday fishing vessels operating in tuna fishery in Sri Lanka

Boat category	Boat Description
UN1	5.5 - 7.2 M (17' - 21') FRP dinghy outboard engine - 8-40 HP (usually 15 - 25 HP) Single day boats - assumed to be fishing in coastal waters
UN2A	8.8 - 9.8 mm (28' - 34') displacement hull. FRP or wooden. Inboard engine (single) - 40 HP No ice box or insulated fish hold, no gear hauler, navigational or acoustic equipments. Single day boats - assumed to be fishing in coastal waters
UN2B	8.8 - 9.8 m (28' - 34'). FRP or wooden, Inboard engine (single) - 40 HP Insulated fish hold - no gear hauler, may have GPS/sounder/fish finder
UN3A	9.8 - 12.2 m (34' - 40'). FRP or wooden. Inboard engine (single) - 60 HP Insulated fish hold and may have gear- hauler/ GPS/sounder/fish finder
UN3B	12.2 m – 15.2 m (40' - 50'). FRP or wooden. Inboard engine (single) - 60 + HP. Insulated fish hold and may have freezer facilities. Gear Hauler/GPS/sounder/fish finder

3. Assessment of gear and vessel catch efficiency

The gear and vessel catch efficiency of frigate tuna was assessed in two ways: (1) based on percentage frequency (probability) of reporting non-zero frigate tuna landings with respect to gear and vessel operated in the tuna fishery and (2) based on non-zero catch rates of frigate tuna with respect to gear and vessels.

3.1. Percentage frequency (probability) of reporting non-zero frigate tuna landings

Only 14% of the total vessels operated in tuna fishery from 2005 – 2014 with above described gear/ gear combinations brought frigate tuna. The highest percentage (36%) of non-zero frigate tuna landings was reported by vessels operated with ringnets whereas the lowest percentage of non-zero frigate tuna landings (8%) was reported by the vessels operated with longline-gillnet gear combination (Figure 1). In terms of different gear combinations, the highest percentage of

non-zero frigate tuna landings (32.5%) was reported by the vessels operated with ringnet - gillnet gear combination.
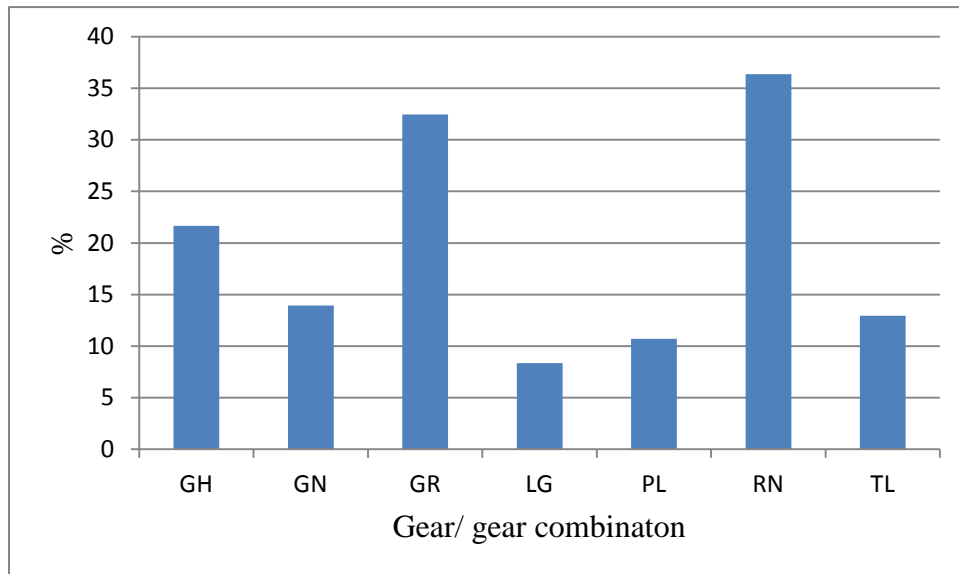

Figure 1. Percentage frequency (probability) of reporting frigate tuna landings in tuna fishery of Sri Lanka as per key gear/ gear combinations: 2005 - 2014 (gillnet (GN), pole & line (PL), ringnet (RN) and trolling line (TL), gillnet-handline (GH), gillnet-ringnet (GR) and longline-gillnet (LG))

A higher percentage of non-zero landings of frigate tuna was reported for UN2B and UN3A vessels whereas the lowest percentage of non-zero frigate tuna landings was reported for UN2A vessels (Figure 2). Accordingly, it could be concluded that the vessels mostly operated in the continental slope and bordering areas of offshore (UN2B and UN3A) report non-zero frigate tuna landings than the other vessels.
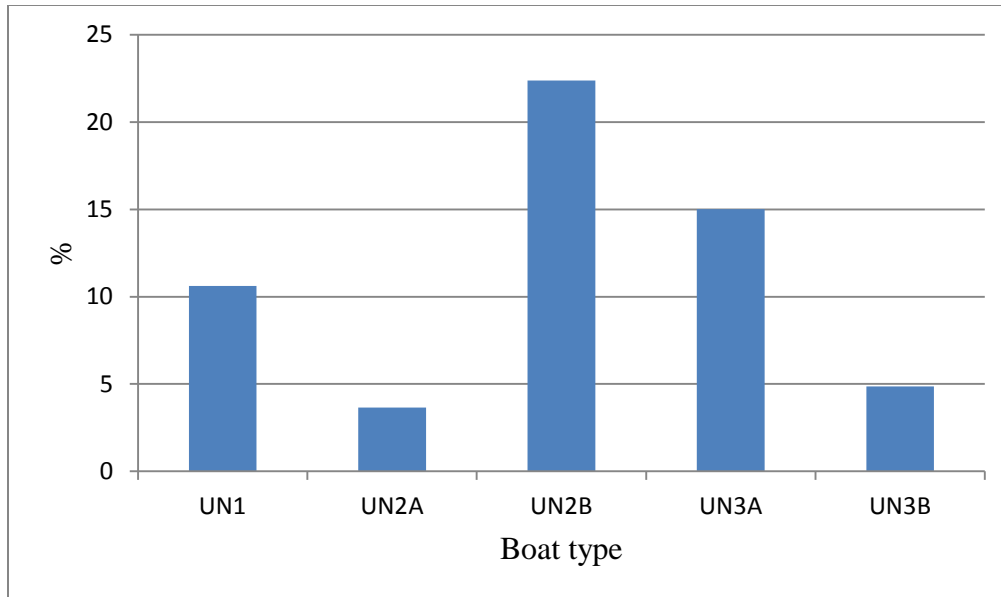
Figure 2. Percentage frequency (probability) of reporting frigate tuna landings in tuna fishery of Sri Lanka as per boat types: 2005 – 2014

3.2.Non-zero catch rates of frigate tuna with respect to different gear and vessels

The average non-zero Catch Per Unit Effort (CPUE) in terms of frigate tuna catch in kilograms per boat per fishing trip (irrespective to fishing gear and vessel) was 177.3Kg. The estimated above CPUE for UN1, UN2A, UN2B, UN3A and UN3B vessel types were 65.2, 74.4, 175.1, 225.0 and 240.2 respectively (Figure 3). On the other hand, the vessels operated with ringnet and gillnet-ringnet gear combination reported higher CPUE than the CPUE of the vessels operated with other gear/ gear combinations (Figure 4).

The estimated average trip duration of the fishing crafts engaged in tuna fishery varied considerably: UN1- 1 day, UN2A- 1 day, UN2B- 7 days, UN3A- 13.4 days and UN3B – 12.7 days. Therefore, above estimated CPUEs by craft types were re-estimated in terms of frigate tuna catch in kg per boat per day (Figure 5). Accordingly, it could be concluded that the average non-zero catch rates in terms of frigate tuna catch in kg per boat per day is higher for single day boats engaged in coastal waters than the multiday fishing boats. It should be noted that some multiday fishing boats which are capable to operate at offshore and deep sea areas are sometimes operated within the coastal areas of Sri Lanka too.
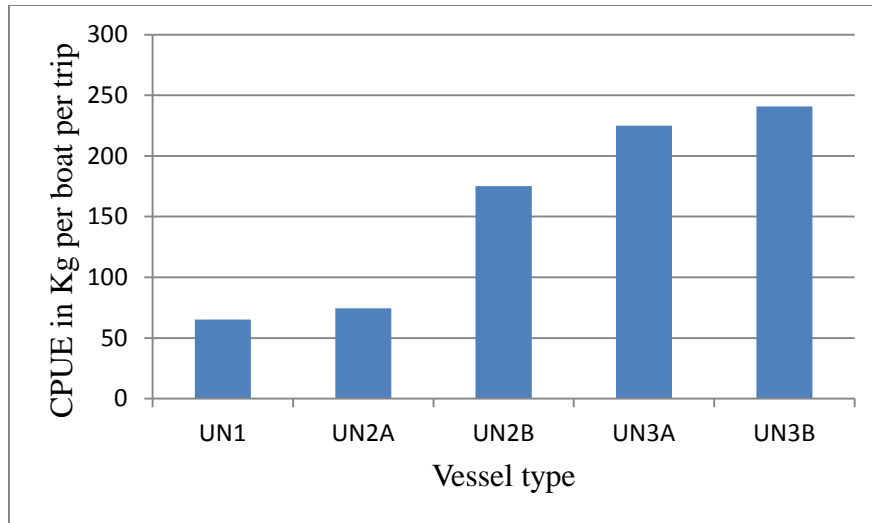
Figure 3. Average non-zero Catch Per Unit Effort (CPUE) in terms of frigate tuna catch in kilograms per boat per fishing trip for different vessels operated in tuna fishery in Sri Lanka during 2005- 2014
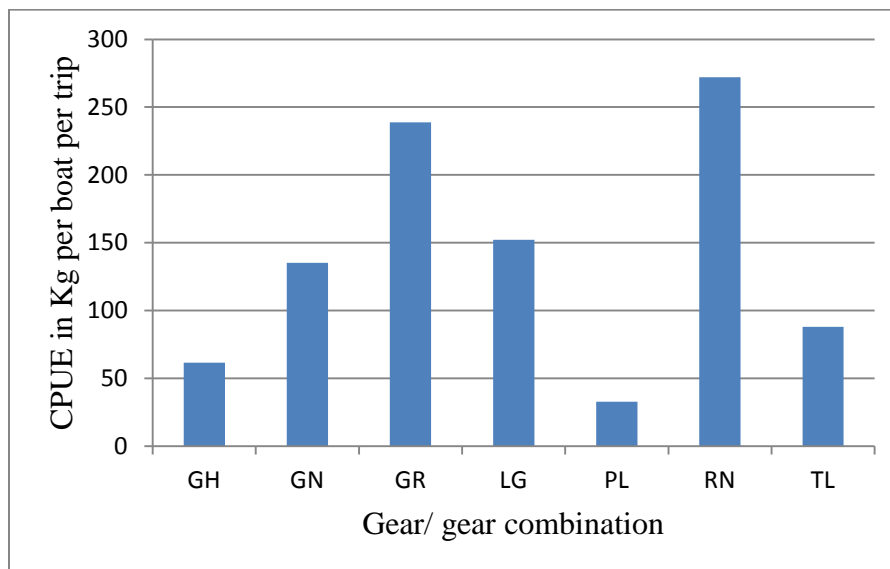

Figure 4. Average non-zero Catch Per Unit Effort (CPUE) in terms of frigate tuna catch in kilograms per boat per fishing trip of vessels operated with different gear/ gear combinations: 2005- 2014 (gillnet (GN), pole & line (PL), ringnet (RN) and trolling line (TL), gillnet-handline (GH), gillnet-ringnet (GR) and longline-gillnet (LG))
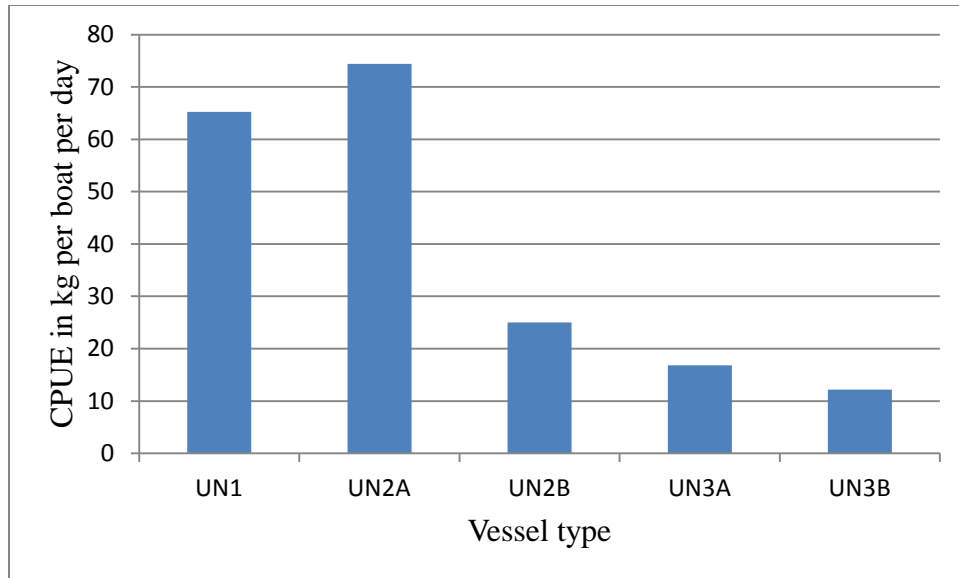
Figure 5. Average non-zero Catch Per Unit Effort (CPUE) in terms of frigate tuna catch in kilograms per boat per day for different vessels operated in tuna fishery in Sri Lanka during 2005- 2014

Conclusion

All Sri Lankan fishing vessel categories engaged in tuna fishery bring frigate tuna. The vessels mostly operated in the continental slope and bordering areas of offshore (UN2B and UN3A) report non-zero frigate tuna catches than the other vessels. On the other hand, the average non-zero catch rates in terms of frigate tuna catch in kg per boat per day is higher for single day fishing boats engaged in coastal waters than other vessels. The study concluded that ringnet is the most efficient gear in Sri Lanka for catching frigate tuna.

Acknowledgements

References

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