Investigating capture rates of Neritic tuna species in the tuna gillnet fisheries of Pakistan; results from four tuna gillnet vessels

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Abstract:

Neritic tuna are extremely important resource for Pakistan, although poorly managed, remains a source of animal protein sustaining livelihoods of fishers. Among neritic tuna, long tail, kawakawa, frigate, bullet and striped bonitos are caught in tuna gillnet fisheries. Here we investigate the capture rates of the neritic tuna in four gillnet vessels and provide a snapshot on how different gear setting impact catch composition of neritic tuna. The different gear settings have proven to be a useful measure without compromising capture rates of tropical tuna species, in addition to reduced bycatch. However, the impact of different gear setting on neritic tuna species has not been determined. This paper therefore, aims to assess capture rates and discusses the catch composition variance by area of fishing and method using the data collected by four trained skippers (on 15-20 m vessels) during January 2013 – December 2017. During this period, a total of 3,430 sets were observed, using two different gear settings viz., surface and sub-surface (2 m below surface) multifilament gillnets. A total of 193,309 neritic tuna were captured equaling to 300,266 Kg representing Long tail (*Thunnus tonggol*), Kawakawa (*Euthynnus affinis*), Bullet tuna (*Auxis rochei*), and Frigate tuna (*Auxis thazard thazard*). The dominant catch based on data collected from four observer vessels belonged to Long tail tuna 52,353 (181,580 Kg), followed by Kawakawa 33,564 (75,035 Kg), Frigate tuna 93,454 (38,273 Kg) and Bullet tuna 13,938 (5,377 Kg). Capture rates were calculated for all neritic tuna species caught for both gear settings. Narrow-barred Spanish mackerel (*Scomberomorus commerson*) catch data was also recorded for the same period.

The results from the study suggest no significant impact on target catch, however, holds promising results as the different gear settings result in positive impact on incidentally caught species. We are encouraged by the results of the study and recommend coupling of technologies such as the use of electronic monitoring systems for triangulating observer data and expanding studies elsewhere, in addition to also studying the gear behavior. Sub-surface gear settings in tuna directed gillnet fisheries provide trade-off among target and non-target catch and may be considered as a potential conservation and management measure in gillnet fisheries.

Introduction:

Tuna and tuna like fishes are key components of pelagic resources, comprising both neritic and oceanic species. There are around 709 tuna gillnet boats which operate in the EEZ of Pakistan (Wasim, 2017). These vessels target large pelagic resources and contribute to around 26.9% of the marine capture fish production, of which the major share belongs to tunas (70%). Among tunas are, tropical species such as yellowfin (33.3%), and skipjack (1.6%), whereas the neritic species include longtail (29.7%), frigate (19.6%), tuna-nei (8.5%) and kawakawa (7.6%). There have been speculations of changing of fishing grounds and drastic increase in fishing operations in the coastal area resulting in changing in the composition of tuna landings in Pakistan. There have been attempts made for reconciliation of this information through the programme run by WWF-Pakistan on the crew-based observers or self-reporting system (Moazzam, 2017).

In addition, the trained captains or skippers involved in data collection have been most useful for providing the data on the different gear settings. This has not been previously documented, however, paper on the impacts of gear settings on incidentally caught species has been determined and shared with working party on ecosystem and bycatch in September 2018 and its impacts on target catches of tropical tuna at the working part on tropical tuna in October 2018. This report presents information on neritic tuna catch difference among the two gear settings in tuna drift gillnets fisheries in Pakistan, and assess the effectiveness of subsurface deployments, to provide evidence and to further research outlining the usefulness of scaling up the sub-surface gear settings in other gillnet fisheries in the Indian Ocean.

Materials and Methods:

In 2012, WWF-Pakistan initiated an observer program, which involved crew members to collect the catch data of Tuna and tuna like species. The crew based observer program continues to date and has 75 trained skippers engaged in data collection. However, we only focus on the four gillnet vessels where five skippers were deployed over the period of January 2013 – December 2017. These skippers were trained for data collection, handling digital cameras (7.5-megapixel handheld camera), provided translated data sheets for entry. The skippers reported data from vessels, fishing operations, vessel size, gillnet lengths, soak times, and species identification was enabled through provision of identification cards developed with IOTC.

In this study we sampled four vessels (five captains) operating from Karachi harbor. These boats are entirely made of wood. Boat length ranges from 15m to 20m. Net lengths (multifilament nylon) of the sampled vessels ranged from 4000m to 7000m in length. These nets are placed at the surface (pelagic gillnets) and have a height of 10m – 14m from the surface with a stretched mesh size of 13cm to 17cm (Moazzam, 2016). The net is usually set in late evening /early morning and hauling starts after 12 hours, and it takes about 2-3 hours on average to haul the net. Sampled vessels mostly operate in the north-eastern Arabian Sea. Fishing operations were confined to the continental shelf waters of the Indus canyon area, continental slope and oceanic waters (Fig. 1).

Data Collection:

The crew based observers are trained in data collection. The observers are provided with data forms translated in the local language (Urdu) and are provided with digital cameras to record the caught species. The captains were trained to document any capture (targeted, non-targeted, including fish, marine reptiles, marine mammals, invertebrates, etc.). During each trip, they recorded fishing hours, position of gillnet sets, the length of net deployed and fishing method (either surface or subsurface net deployment). Gillnet sets had an average duration of 12 hours. The captains were provided digital cameras (to confirm species identification), global position system (GPS) devices and data recording templates based on Indian Ocean Tuna Commission (IOTC) requirements were also provided. (Kiszka.J et al. 2018).

2.3 Data analysis

Captures per Unit of Effort (CPUEs) were calculated and compared between taxa and fishing methods using the following formula:

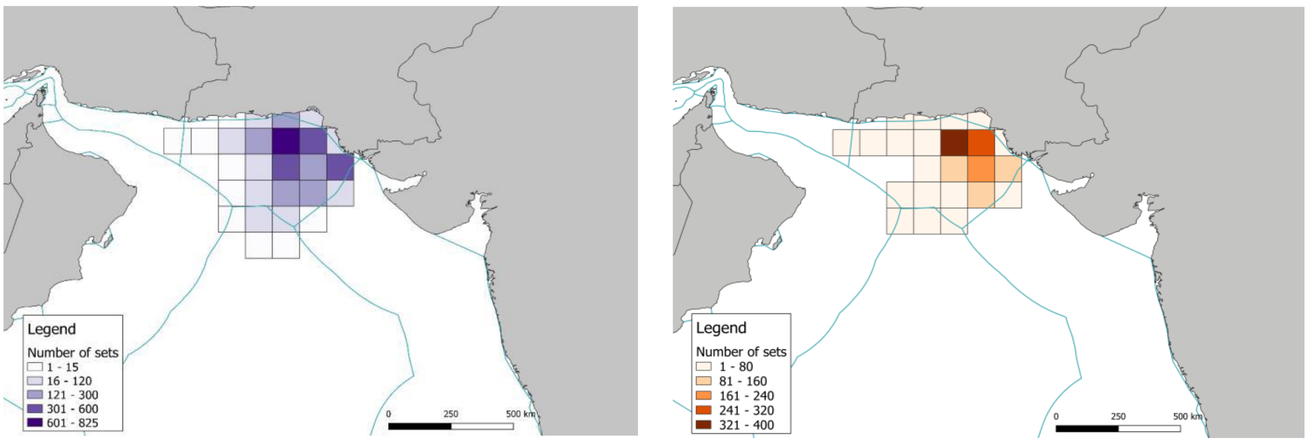
$$CPUE = (Nt/Ns)/ln$$

where, N_t is the total weight, N_s is the total number of sets and l_n is the total length of net in km

Results:

3.1 Total Fishing effort

From January 2013 to December 2017, a total of 3,430 drift gillnets were monitored. During this period, a total of 3,430 sets were observed, using two different gear settings viz., surface and sub-surface (2 m below surface) multifilament gillnets. A total of 193,309 neritic tuna were captured equaling to 300,266 Kg representing longtail (*Thunnus tonggol*), kawakawa (*Euthynnus affinis*), bullet tuna (*Auxis rochei*), and frigate tuna (*Auxis thazard thazard*). The dominant catch belonged to longtail tuna 52,353 (181,580 Kg), followed by Kawakawa 33,564 (75,035 Kg), frigate tuna 93,454 (38,273 Kg) and bullet tuna 13,938 (5,377 Kg). Based on the set locations (fig 1) the highest concentration of surface and sub-surface deployments were reported on the continental slope around Indus Canyon area with concentration of around 601-825 surface and 321-400 sub-surface sets. Overall, the spatial data based on catches from both gears i.e. surface and subsurface have been provided for each neritic species.



a). *b).*

Figure 1: a). Surface and b). sub-surface gear deployments of the tuna drift gillnet fishing effort (number of sets per 1° cell) off Pakistan from 2013 to 2017 (Source: Kiszka et al., 2018)

Overall, all neritic tuna species account for 30% of catches. Neritic tuna CPUEs in surface and subsurface gillnets were significantly different. We see these comparisons in the light of spatial data available.

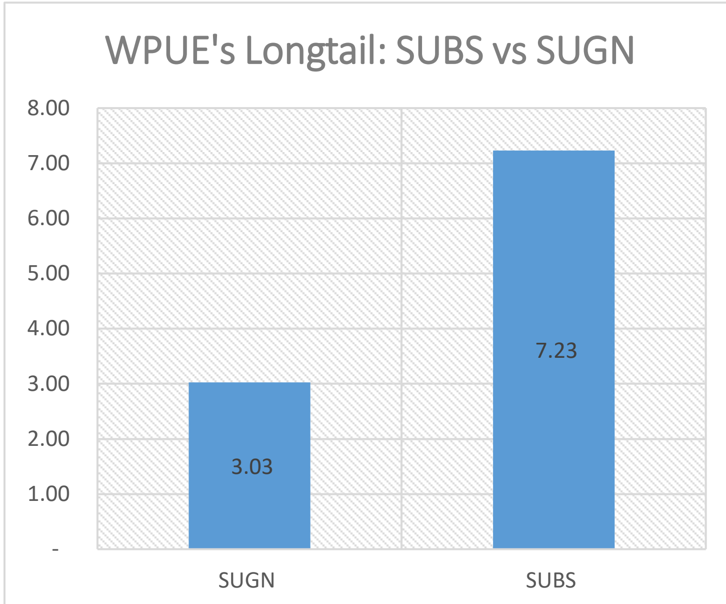
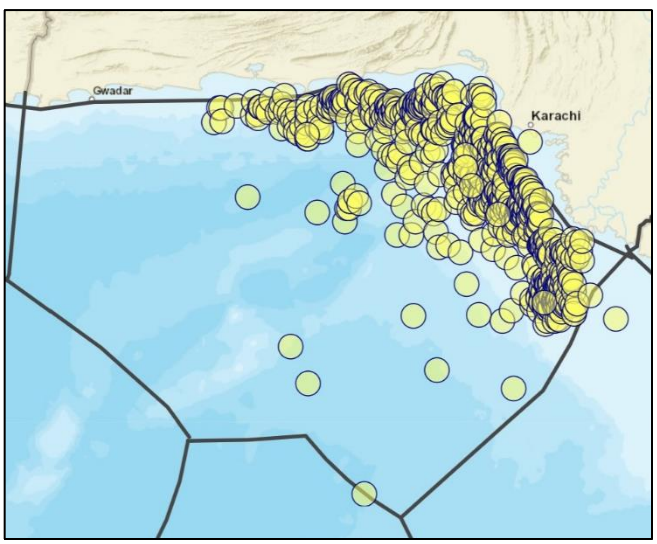


Figure 2: Weight in Kg (yield) per unit of effort for Long tail tuna in surface and sub-surface gear setting



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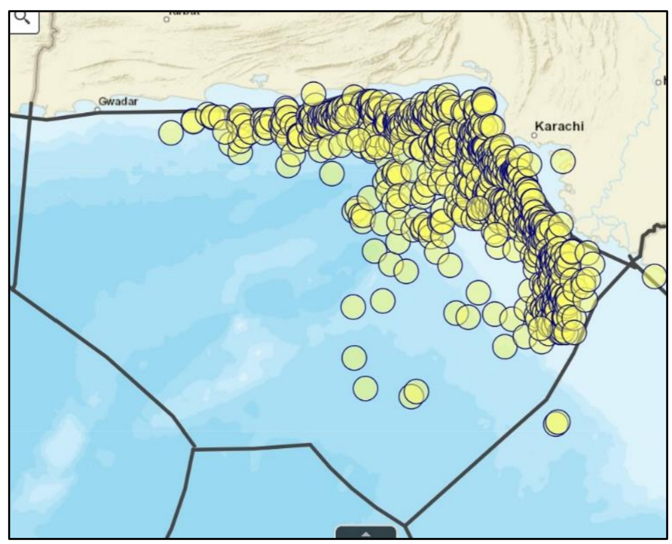

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Figure 3: a) Surface gillnetting fishing location of Long tail Tuna; b). Sub-surface gear fishing locations of Long Tail Tuna

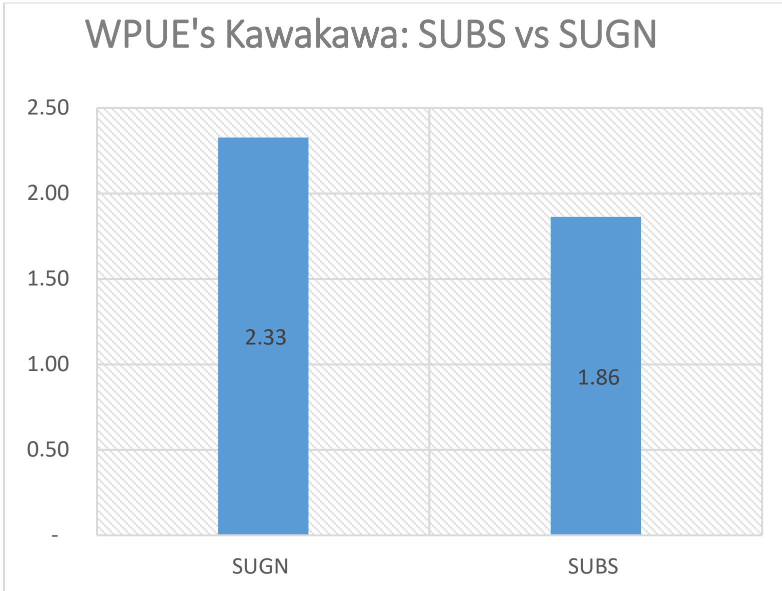
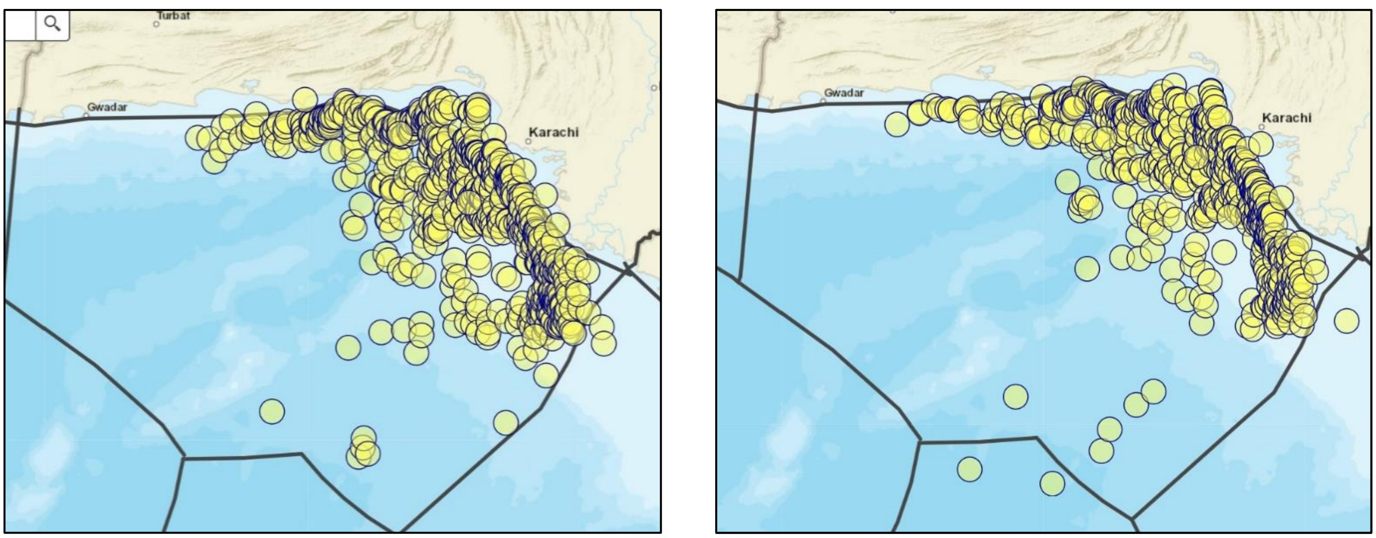


Figure 4: Weight in Kg (yield) per unit of effort for Kawakawa tuna in surface and sub-surface gear setting



a)

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Figure 5: a) Surface gillnetting fishing location of Kawakawa Tuna; b). Sub-surface gear fishing locations of Kawakawa Tuna

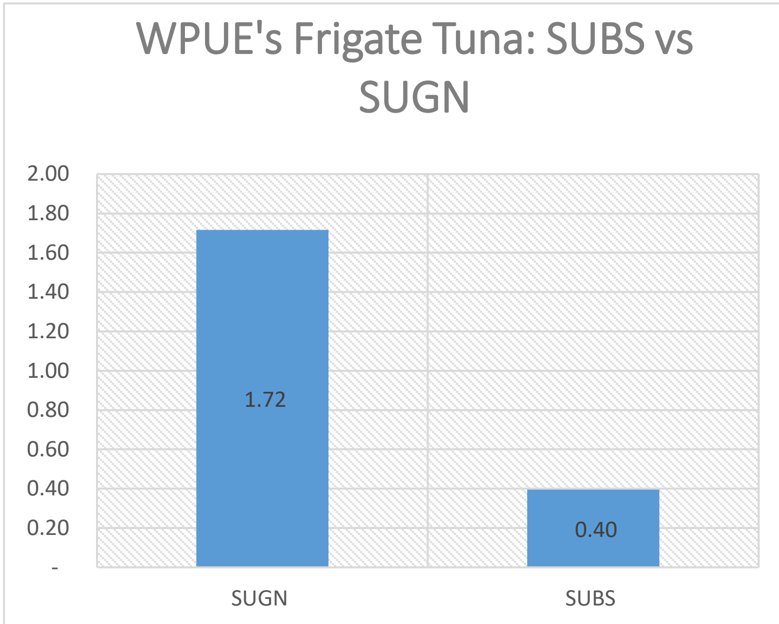
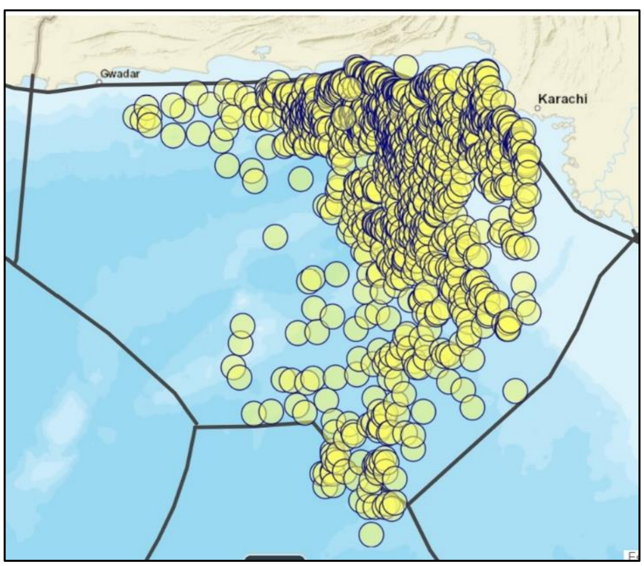


Figure 7: Weight in Kg (yield) per unit of effort for Frigate tuna in surface and sub-surface gear setting



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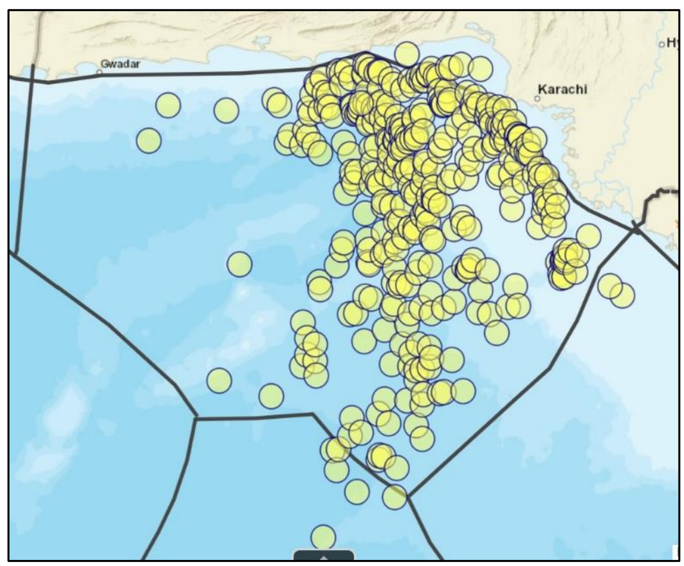

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Figure 6: a) Surface gillnetting fishing location of Frigate Tuna; b). Sub-surface gear fishing locations of Frigate Tuna

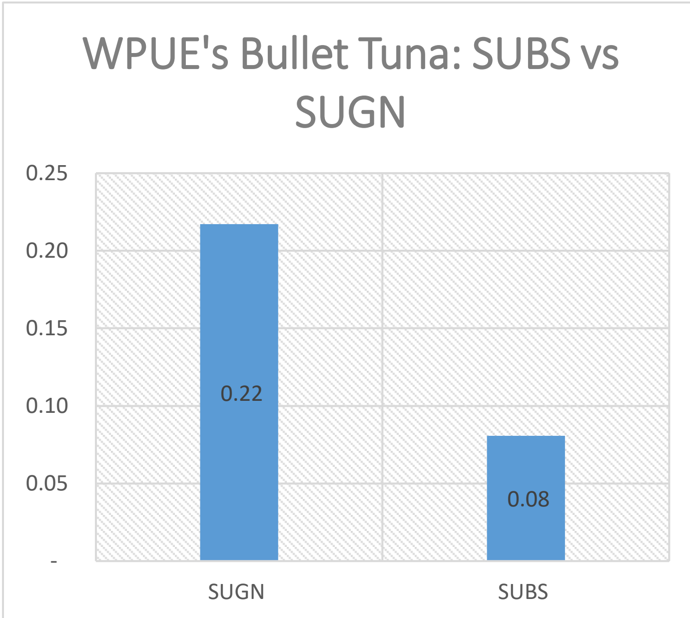

Figure 8: Weight in Kg (yield) per unit of effort for Bullet tuna in surface and sub-surface gear setting

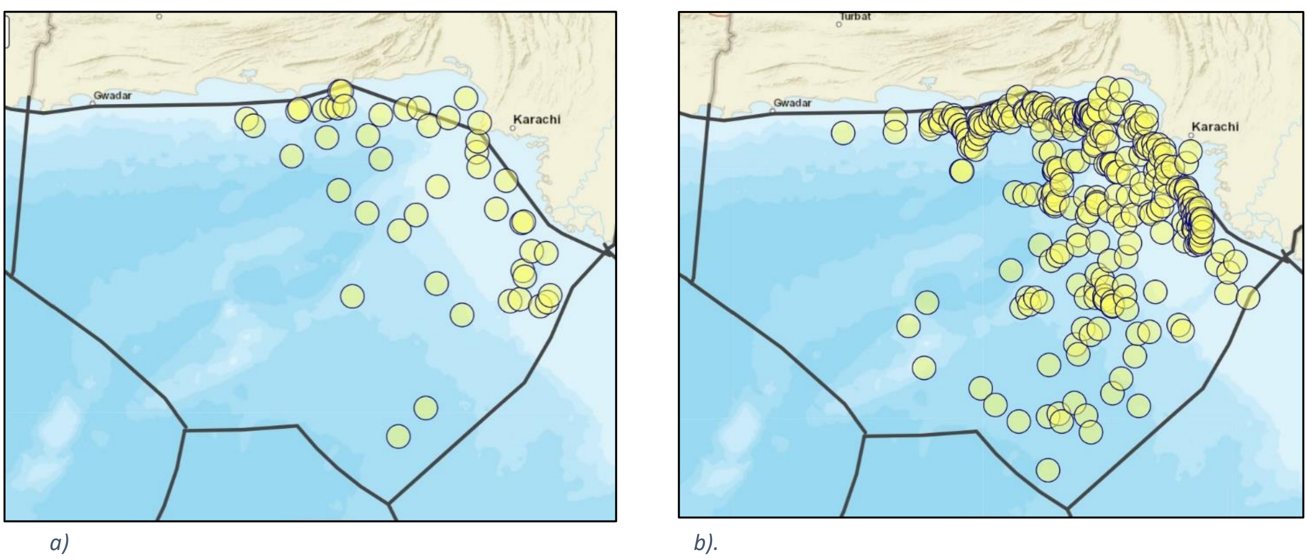

Figure 9: a) Surface gillnetting fishing location of Bullet Tuna; b). Sub-surface gear fishing locations of Bullet Tuna

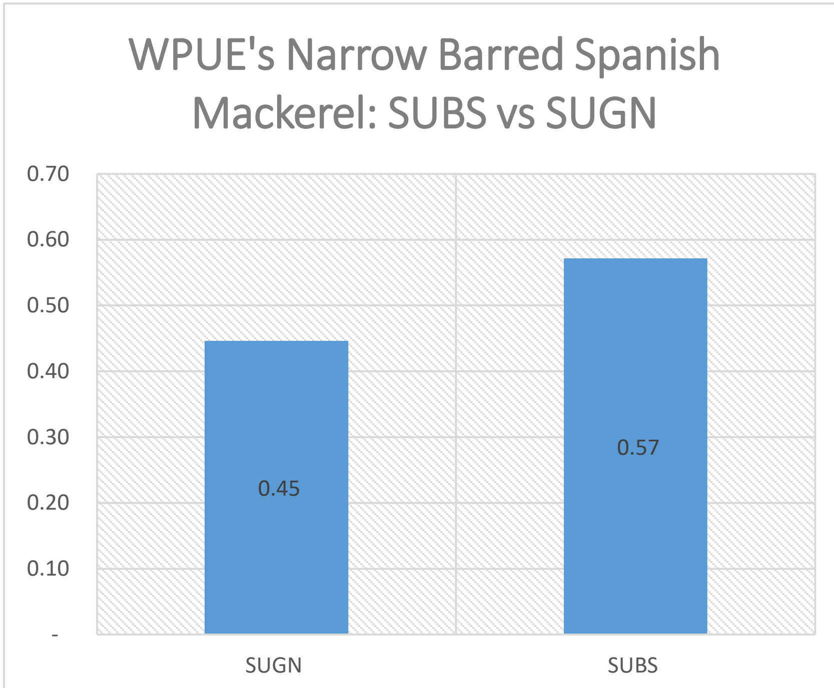

Figure 10: Weight in Kg (yield) per unit of effort for Narrow Barred Spanish Mackerel in surface and sub-surface gear setting

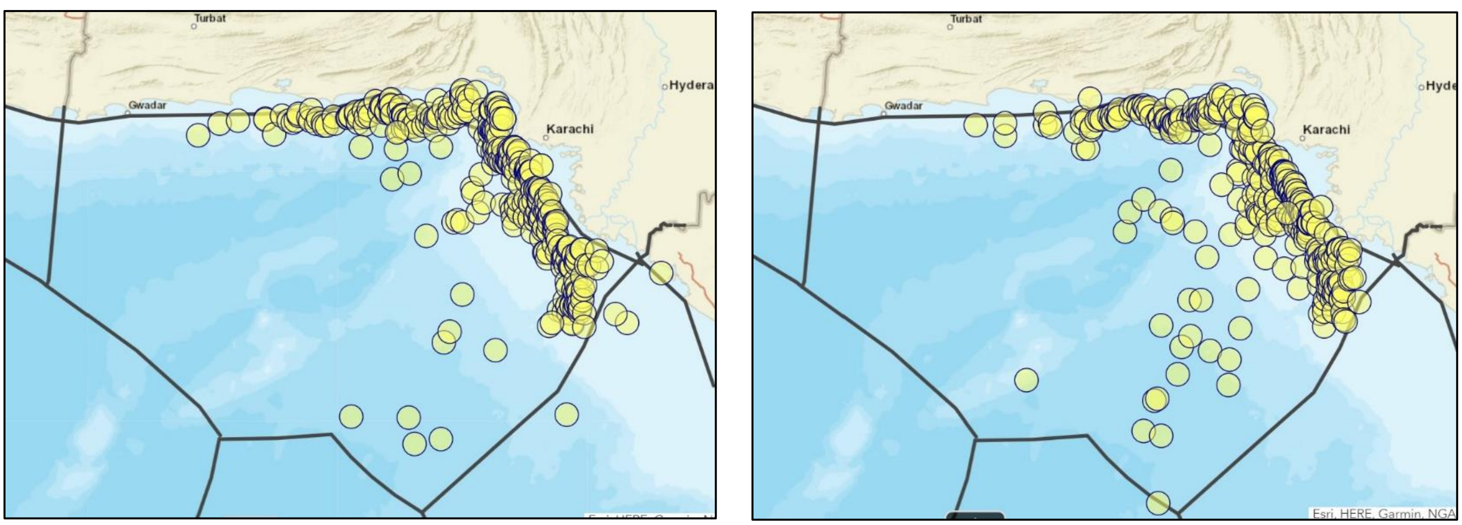

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Figure 11: a) Surface gillnetting fishing location of Narrow Barred Spanish Mackerel; b). Sub-surface gear fishing locations of Narrow Barred Spanish Mackerel

Discussions:

Neritic Tuna is the most undermanaged Tuna species groups amongst the other IOTC species. IOTC in the recent secretariat general meeting has expressed its concerns over this issue and has advised the cooperating and non-cooperating parties of the IOTC to improve data collection mechanisms as 80% of catch data is estimated.

WWF-Pakistan is working closely with the Government of Pakistan to improve data collection mechanism. There are 75 trained observers on the gill net vessels operating in the Pakistan EEZ under the ABNJ project. The data provided by these observer's aid in strengthening data collection mechanism.

Moreover, WWF-Pakistan encouraged observers under the project to experiment of use sub-surface gear. The success of the sub-surface gear has been mentioned a number of times in the past working party meetings (Kiszka et. al, 2018, Shahid et. al, 2018). It was attempted to compare Neritic Tuna catch with different gear settings. Figure 7 gives a clear picture of the difference in catch rates. It is very clearly observed that the CPUE of Long Tail Tuna has risen drastically as compared to the other species, we can notice the change from 3.03 to 7.23. In the case of Kawakawa, the CPUE valued stayed relatively similar with a difference of 0.5 being more in the Surface gillnetting. Influence of gear has been observed in case of Frigate Tuna as the CPUE value fluctuates drastically from 1.72 and decreases to 0.40. Bullet tuna catch has also decreased, so it is evident on the CPUE value also. But in case of the Tuna-like specimen, Spanish Mackerel, the CPUE value seems to increase to 0.57 which is slightly more than 0.45 in case of surface gillnetting gear.

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