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Operational pattern of Japanese longliners in the south of 25S in the Atlantic and the Indian Ocean for the consideration of seabird bycatches

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SUMMARY

Catch and effort data of Japanese longliners operated in the south of 25S in the Atlantic and the Indian Oceans in the period between 2010 and 2015 was analyzed to investigate its effect on the seabird bycatch. Off South Africa waters and the southwest Indian Oceans were indicated to be main fishing ground of Japanese longliner, where they caught southern bluefin tuna, albacore, bigeye and yellowfin tunas. Results of analysis indicate general tendency of increased ratio of southern bluefin tuna and decreased ratio of albacore and bigeye tunas to in between 2010 – 2013 and 2014 – 2015. This target shifts accompanied the southward shift of operational ground. The results of this study also indicated that the main fishing ground of Japanese longliners in off South Africa located further south area at about 5 degrees than the one in the southwest Indian Ocean due to the effect of warm Agulhas Current. These findings should be considered in the analysis of seabird bycatch data.

KEYWORDS: *Catch/effort, Longline, bycatch*

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1. Introduction

High latitudinal area of the south Atlantic and the south Indian Oceans are one of important regions for Japanese far seas longliners to catch high quality tunas like southern bluefin tuna. At the same time, longline operations in this region is known to bycatch seabirds, many of them need to be conserved due to their low stock condition. In the present study, catch and effort data of Japanese longliners in the period between 2010 and 2015 was analyzed to the benefit of the sea birds bycatch data analysis.

2. Material and Methods

Set by set data obtained by logbook, which has been compiled at the National Research Institute of Far Seas Fisheries (NRIFSF) from 2010 to 2015, was used in this study. Fisherman engaged in the distant water longline mandatorily submits the logbook to NRIFSF through Fishery Agency of Japan. Generally, the coverage of the log-book of offshore and distant water longliners is quite close to 100%. In the analysis, data of sets located in the north of 25S and in the Pacific Ocean was excluded. Area designation used in the analysis is shown in Figure 1. For the analysis, reported catch of blue marlin, striped marlin, black marlin sailfish and spear fish are combined as marlins.

3. Results and discussions

The annual amount of effort in the Atlantic was fluctuated in the range between 1.5 – 2.5 million hooks (Figure 2). It increased from 9 million hooks in 2010 to 11 million in 2015 in the east Indian Ocean, and decreased from 12 million hooks in 2010 to 5.5 million hooks in the west Indian ocean. In the region analyzed, the amount of effort occurred in the south of 45S was negligible. The ratio of hooks deployed in the southern areas increased in the Atlantic Ocean (area 2) and in the east Indian Ocean (area 23) where Japanese longliners actively targeting southern bluefin tuna (Figures 2 and 3).

Southern bluefin tuna mainly caught in areas 2, 8 and 23, and blue sharks and porbeagle seems to be caught more or less in the same areas as southern bluefin tuna (Figure 3). Among major catch species of tuna pelagic longlines, abundance of blue shark and porbeagle were suggested to be higher in the cold current oriented water mass (Yatsu, 1995; Nakano and Seki, 2003) where seabirds distributing abundantly. Albacore, bigeye tuna and yellowfin tuna caught in lowest latitudinal areas placed in 25S – 35S (Figure 4). Some of them were also caught in the southern areas placed in 35S – 45S and ratio of catch caught in these areas were highest in albacore and lowest in yellowfin tuna. This indicates that albacore distribute coldest waters among these three tunas and yellowfin distribute warmest waters.

Off South Africa region is one of important fishing ground for Japanese longliners. In the latitudinal band of 25S – 35S, albacore dominated in the catch in the western side of South Africa (areas 1and 4) while yellowfin tuna dominated in the eastern side (Figure 5). In the latitudinal band of 35S – 45S, southern bluefin tuna is dominated in the most western area (area 2) and albacore was most popular tunas in other 3 areas. Some notable number of yellowfin tuna catches only appeared in area 8. This apparent change of species composition of the catch should be due to the influence of the Agulhas warm current. Among four areas in the latitudinal band of 35S – 45S, influence of the Agulhas current seems rather low in area 2 where southern bluefin tuna, which seems to prefer coldest waters among four major tunas (southern bluefin tuna, albacore, bigeye tuna and yellowfin tuna), dominated (Figure 5). Area 8 seems to receive largest influences by the Agulhas current and this would be the reason why some large number of yellowfin tuna catch appeared in this area. Southern bluefin tuna is most popular species among catches of the areas in the latitudinal band of 45S – 55S (areas 3, 6, and 9). Porbeagle, which mainly distributes in cold waters, only caught in these areas. Considering the fact that many albatross species mainly distribute in the area of cold waters (Pinaud and Weimerskirch, 2007), sets conducted in areas 2, 3, 6 and 9 would have larger seabird bycatches. Among these four areas, southern bluefin tuna catch in area 2 is much larger than others and amount of effort in area 2 increased in most recent years (Figure 2).

The southwestern Indian Ocean is another important fishing region for Japanese longliners. Different from the catch distribution pattern in the off South Africa region, almost no sets occurred in the areas south of 45 in this region (Figure 6). In addition, almost no yellowfin tuna catches obtained in this yellowfin tuna catch obtained in this region. This would be due to the absence of warm current in the southwestern Indian Ocean. Southern bluefin tuna catch is mainly obtained in area 23 where largest amount of effort deployed since 2014 (Figure 2) while its ratio to the total is low. In this region, amount of effort in the latitudinal band of 25S – 35S (areas 19 and 22) largely decreased since 2014 and amount of effort in the latitudinal band of 35S – 45S (areas 20, 23 and 26) increased (Figure 2).

Because the effect of latitude seems to have large influence in the species composition of the catch, its effect further analyzed for areas with large number of catches. Catch species composition of area 2 largely changed between northern and southern half parts (Figure 8). Albacore and blue shark were dominated in the northern part (35S – 40S), while southern bluefin tuna, marlins and blue shark were major species in the southern part. The amount of effort deployed in the northern part of area 2 was negligible. The amount of effort in the southern part largely increased in the southern part in most recent years, and ration of southern bluefin tuna increased along with the effort increase. This suggested that the sets targeting southern bluefin tuna increased in area 2 in most recent years.

Yellowfin tuna and albacore were major species in the northern part of area 8 and this replaced by southern bluefin tuna, albacore, marlins and blue shark in the southern part (Figure 9). Majority of efforts deployed in the southern part and it largely decreased in most recent years. Yellowfin tuna was dominated in the northern part of area 10 (Figure 10) and this replaced by albacore in the southern part. Almost effort was deployed in the southern part in area 10 (Figure 10), and it showed consistent decreasing trend since 2011. The comparison of catch and effort data between the northern and the southern parts of major fishing areas in the off South Africa region shows that catch species composition largely changed between the northern and the southern parts of major areas. This supposed to be the fact that the strong warm Agulhas current caused complicated environmental condition in this region (Figure 5). The results of this analysis also indicated that effort seemed to be shifted to the southern part of area 2 in recent years where ratio of southern bluefin tuna was high. This would be due to the recent increase of Japanese allocation of southern bluefin tuna (CCSBT, 2015).

In the southwestern Indian Ocean, areas 19, 22, and 23 were major fishing area for Japanese longliners. In both area 19 and 22, albacore and bigeye tuna were seemed to be major species and catch species composition were not changed largely between their northern and southern parts (Figures 11 and 12). In both areas, almost efforts deployed in their southern parts, and amount of effort in area 19 almost disappeared since 2014. Instead of this decrease of effort in area 19, amount of effort in area 23 increased largely since 2014 (Figure 13). In this area, catch species composition largely changed between the northern and the southern parts. Albacore was dominated in the northern part, and southern bluefin tuna, marlins and blue shark were major species in the southern part. Almost effort deployed in the northern part in area 23. These facts written above indicate that effort shifted to the northern part of area 23 since 2014 from the southern part of area 19. Considering species compositions of these areas, this effort shift would be for the change of target species from bigeye tuna to southern bluefin tuna, which would be due to the recent increase of Japanese allocation of southern bluefin tuna.

Quarterly patterns of amount of effort by area indicate that main fishing season were 2nd quarter in the Atlantic Ocean, and 2nd and 3rd quarters in the Indian Ocean (Figure 14). In the Atlantic Ocean and the eastern Indian Ocean (means operations in off South Africa region), effort in 1st and 4th quarters became rather low. In the Atlantic Ocean, ratio of efforts deployed in area 2 largely increased since 2014. Ratio of efforts deployed in area 23 largely increased since 2013.

The results of the catch and effort analysis of Japanese longliners in the area south of 25S in the period between 2010 and 2015 indicated that Japanese longliners mainly targeted southern bluefin tuna as well as other tuna species such as bigeye tuna mainly in the 2nd and 3rd quarters in the off South African region as well as in the southwest Indian Ocean. The effort deployed in this area seems to be reallocated to the more southern areas since 2014 or end of 2013, which would be to change target to southern bluefin tuna from other tuna species. The magnitude of shift of effort to the southern direction is seemed to be about 5 degrees in latitude. The position of main fishing ground of southern bluefin tuna in the off South Africa region is about 5 degrees south of the ones in the southwestern Indian Ocean, which would be due to the influence of Agulhas warm current in the off South Africa region. In the main fishing ground of Japanese longliners in off South Africa region, species composition of the catch of Japanese longliners is largely changed by 5 degrees in latitude which suggest fact that Agulhas current cause some complicated environmental condition in this region. These observations should be considered in the analysis of bycatch data of seabird caught by longline fisheries.

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	10W - 10E	10E - 20E	20E - 30E	30E - 40E	40E - 55E	55E - 70E	70E - 100E	100E-110E	110E-120E	120E-150E
25S - 35S	area 1	area 4	area 7	area 10	area 13	area 16	area 19	area 22	area 25	
35S - 45S	area 2	area 5	area 8	area 11	area 14	area 17	area 20	area 23	area 26	area 28
45S - 55S	area 3	area 6	area 9	area 12	area 15	area 18	area 21	area 24	area 27	area 29
	Atlantic Ocean		West Indian Ocean				East Indian Ocean			

Figure 1: Area designation used in this study.

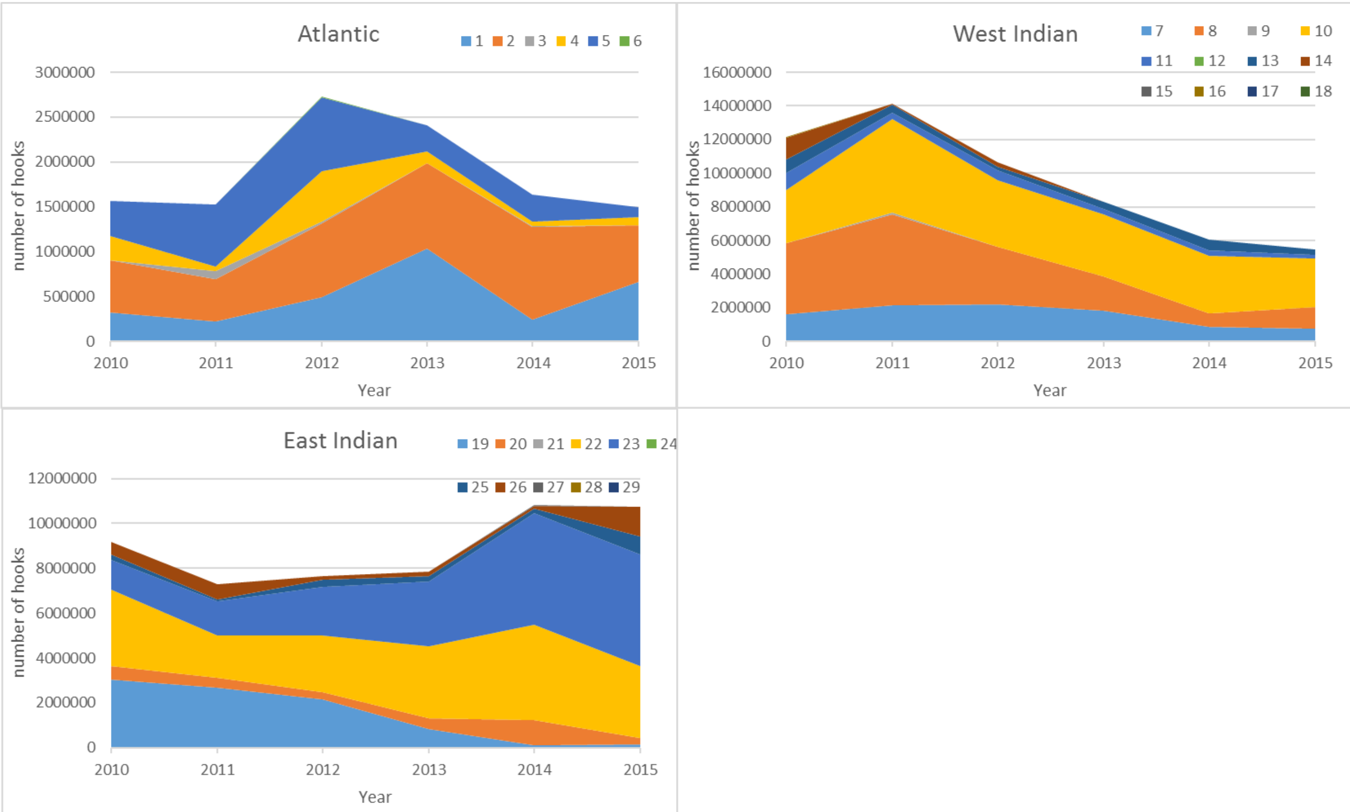

Figure 2: Annual amount of effort (number of hooks) of Japanese longliners by area in The south of 25S in 2010 - 2015.

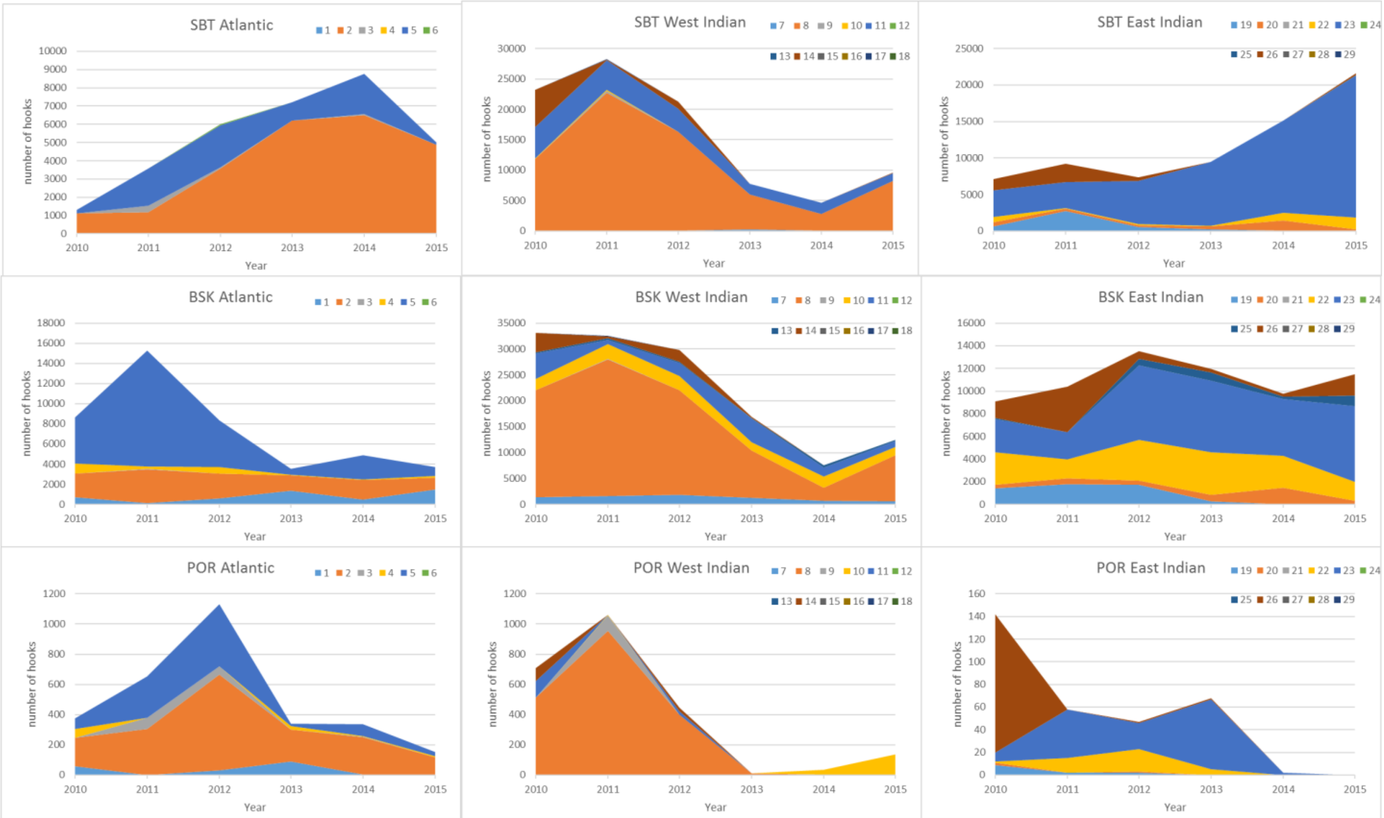

Figure 3: Catch number by area of southern bluefin tuna (top row), blue shark (middle row) and porbeagle (bottom row) by area in the Atlantic (left column), the west Indian (middle column) and the east Indian (right column) Oceans during 2010 – 2015.

Figure 4: Catch number by area of albacore (top row), bigeye tuna (middle row) and yellowfin tuna (bottom row) by area in the Atlantic (left column), the west Indian (middle column) and the east Indian (right column) Oceans during 2010 – 2015.

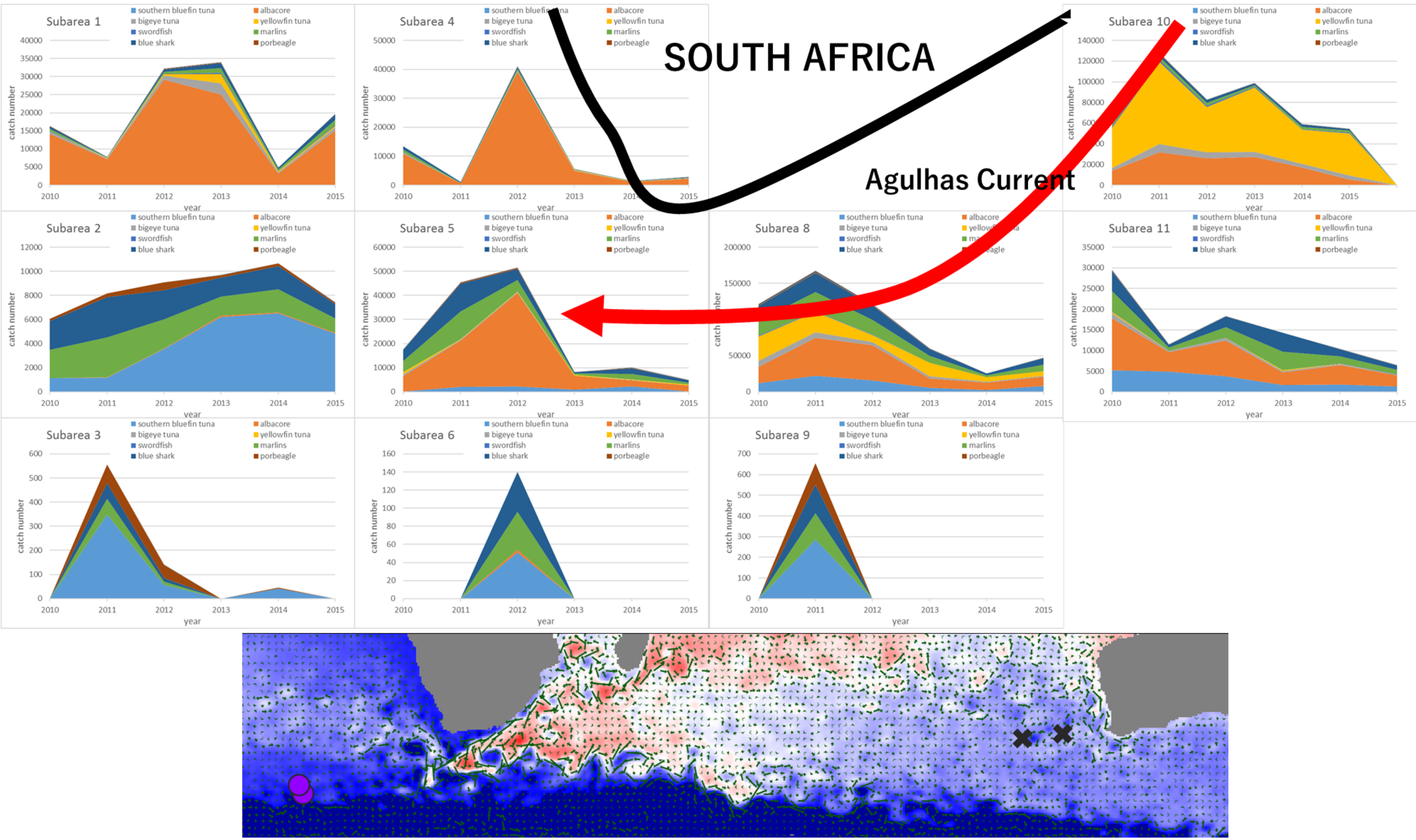
SOUTH AFRICA
Agulhas Current
Subarea 1
Subarea 2
Subarea 3
Subarea 4
Subarea 5
Subarea 6
Subarea 8
Subarea 9
Subarea 10
Subarea 11
southern bluefin tuna
albacore
bigeye tuna
yellowfin tuna
swordfish
marlins
blue shark
porbeagle
catch number
year

Figure 5: Schematic figure of catch change of operational pattern of Japanese longliners in southwest Indian Ocean during 2010 - 2015 shown by area specific species composition (upper). The sea surface height image in 11th June 2014 is shown (lower) for the comparison. Colored closed circles in sea surface height image shows the positoin of sea bird bycatch and black closses shows positoins of sets without bycatch.

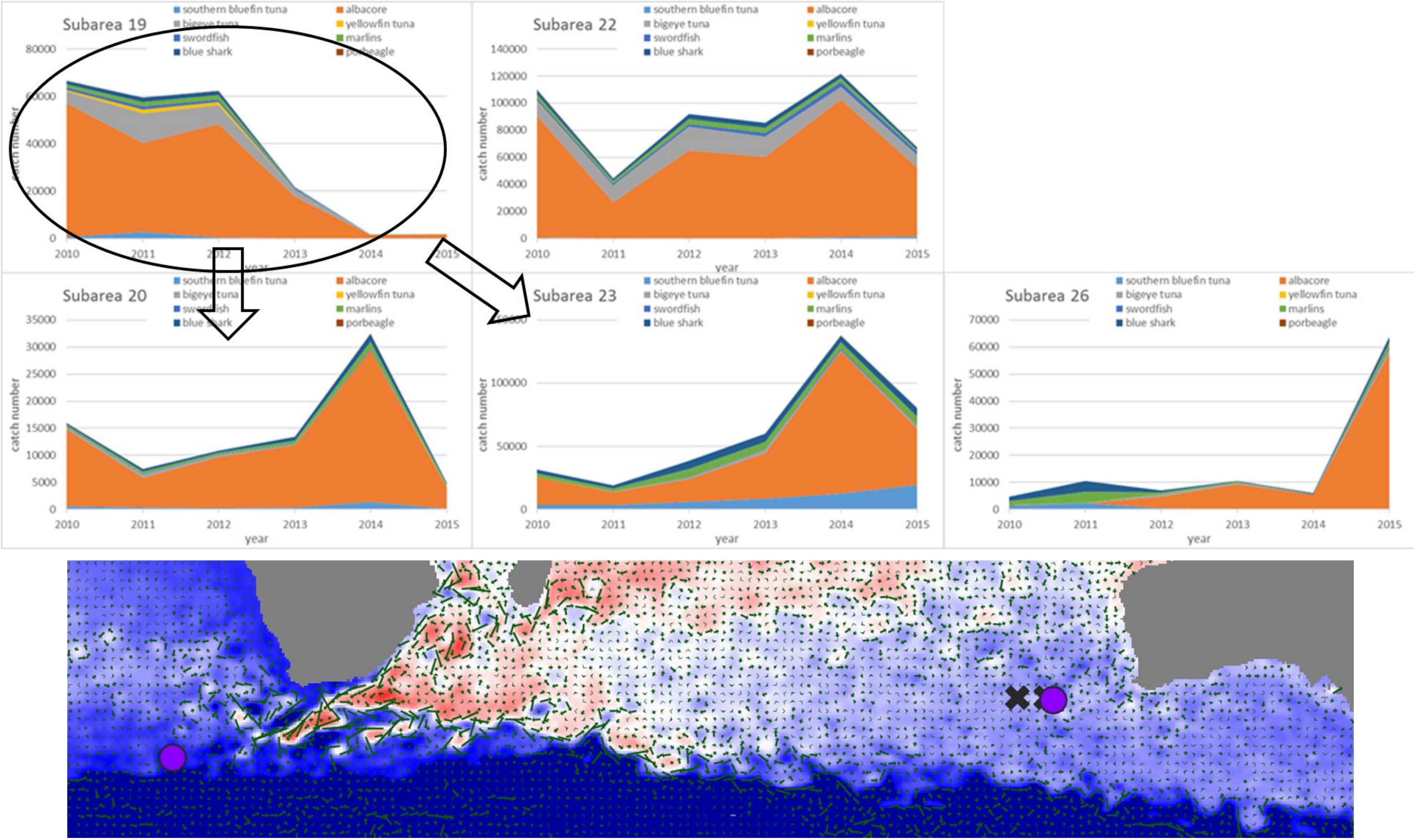

Figure 6: Schematic figure of catch change of operational pattern of Japanese longliners in southwest Indian Ocean during 2010 - 2015 shown by area specific species composition (upper). The

sea surface height image in 3rd May 2014 is shown (lower) for the comparison. Colored closed circles in sea surface height image shows the positoin of sea bird bycatch and black closses shows positoins of sets without bycatch.

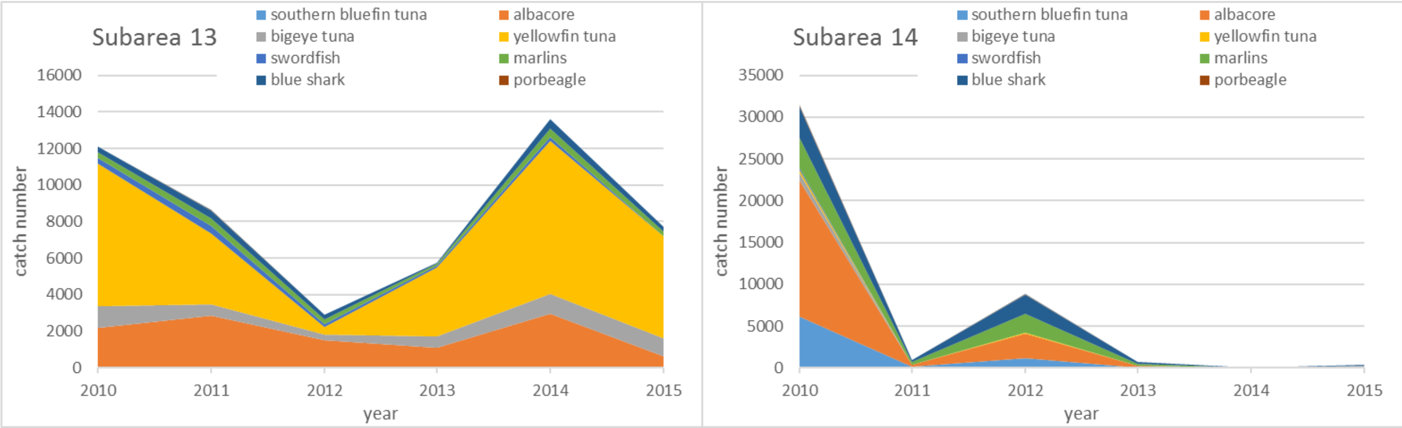

Figure 7: Catch number by species in areas 13 and 14 during 2010 – 2015 of Japanese longliners.

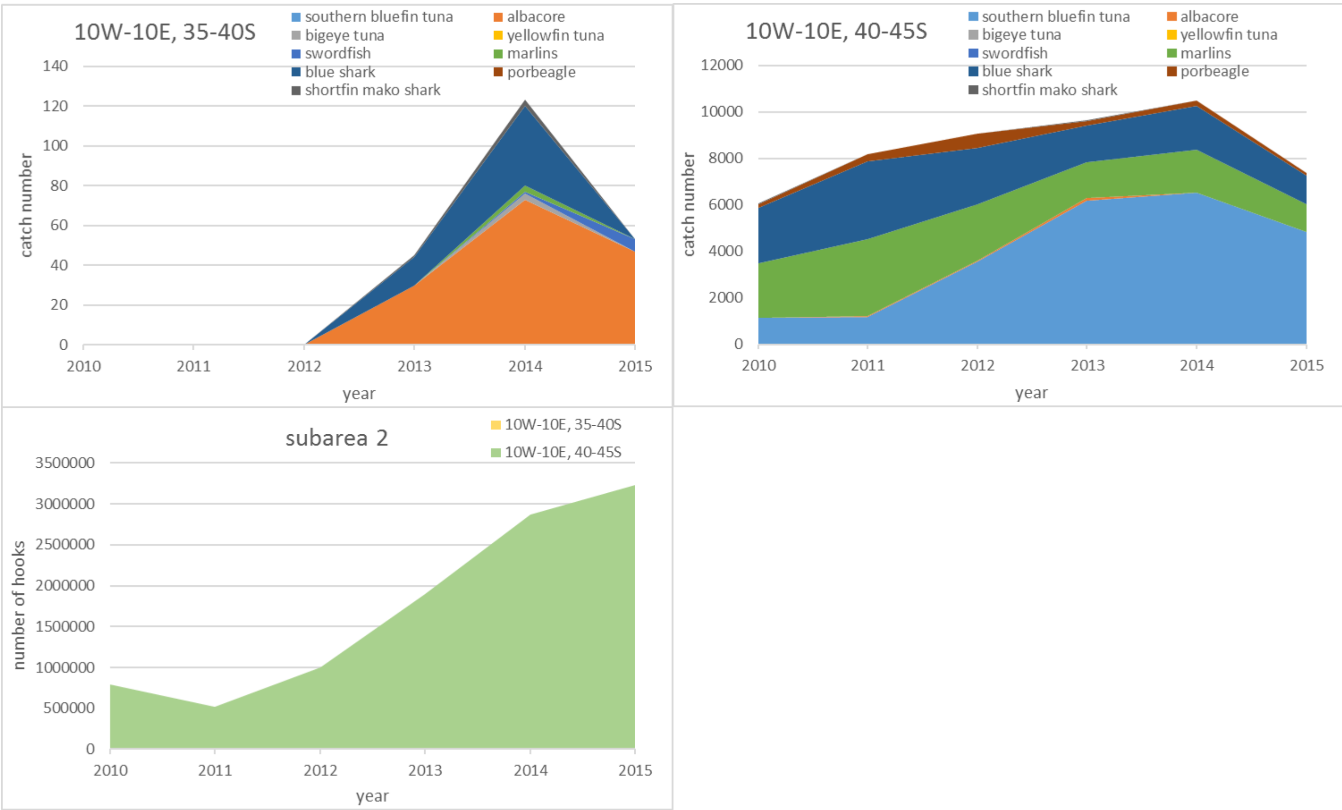

Figure 8: Catch number by species by 5 degrees' latitudinal band in area 2 of Japanese longliners during 2010 – 2015 (upper two panels), and amount of effort by 5 degrees' latitudinal band in area 2 (lower panel).

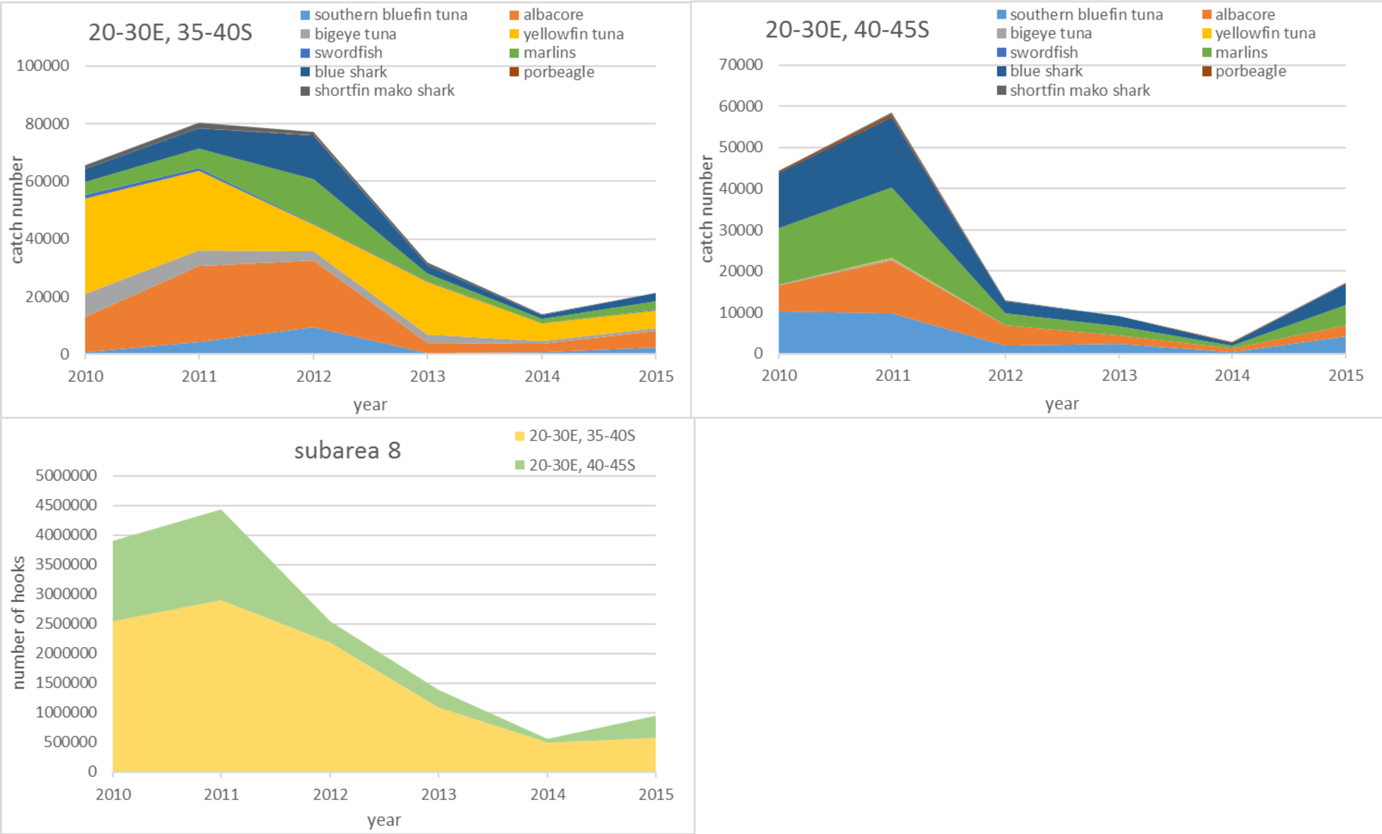

Figure 9: Catch number by species by 5 degrees' latitudinal band in area 8 of Japanese longliners during 2010 – 2015 (upper two panels), and amount of effort by 5 degrees' latitudinal band in area 2 (lower panel).

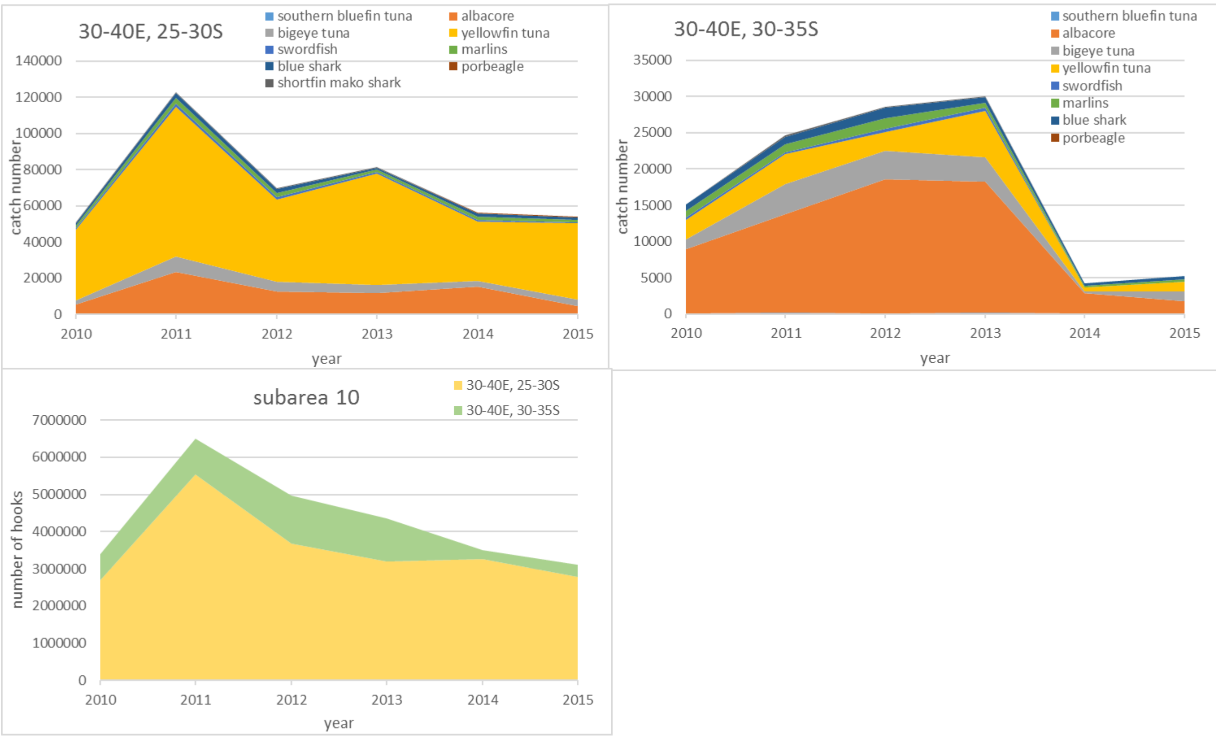

Figure 10: Catch number by species by 5 degrees' latitudinal band in area 10 of Japanese longliners during 2010 – 2015 (upper two panels), and amount of effort by 5 degrees' latitudinal band in area 2 (lower panel).

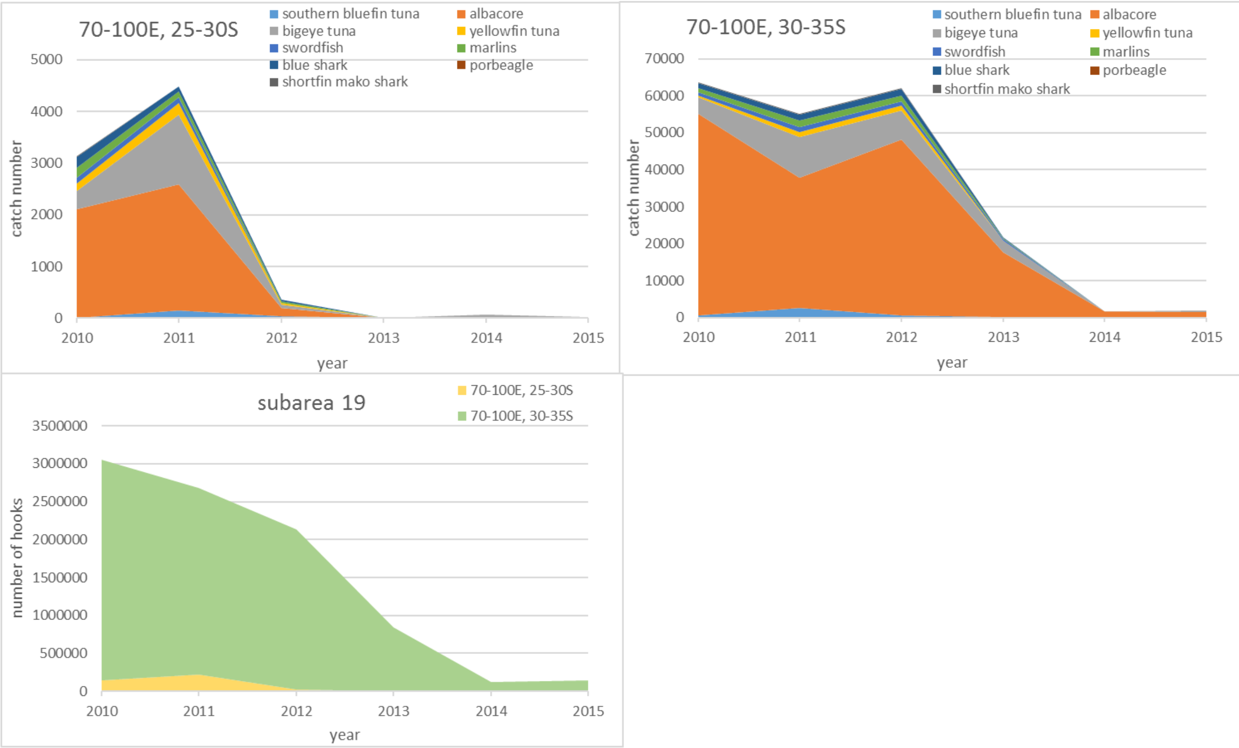

Figure 11: Catch number by species by 5 degrees' latitudinal band in area 19 of Japanese longliners during 2010 – 2015 (upper two panels), and amount of effort by 5 degrees' latitudinal band in area 2 (lower panel).

Figure 12: Catch number by species by 5 degrees' latitudinal band in area 22 of Japanese longliners during 2010 – 2015 (upper two panels), and amount of effort by 5 degrees' latitudinal band in area 2 (lower panel).

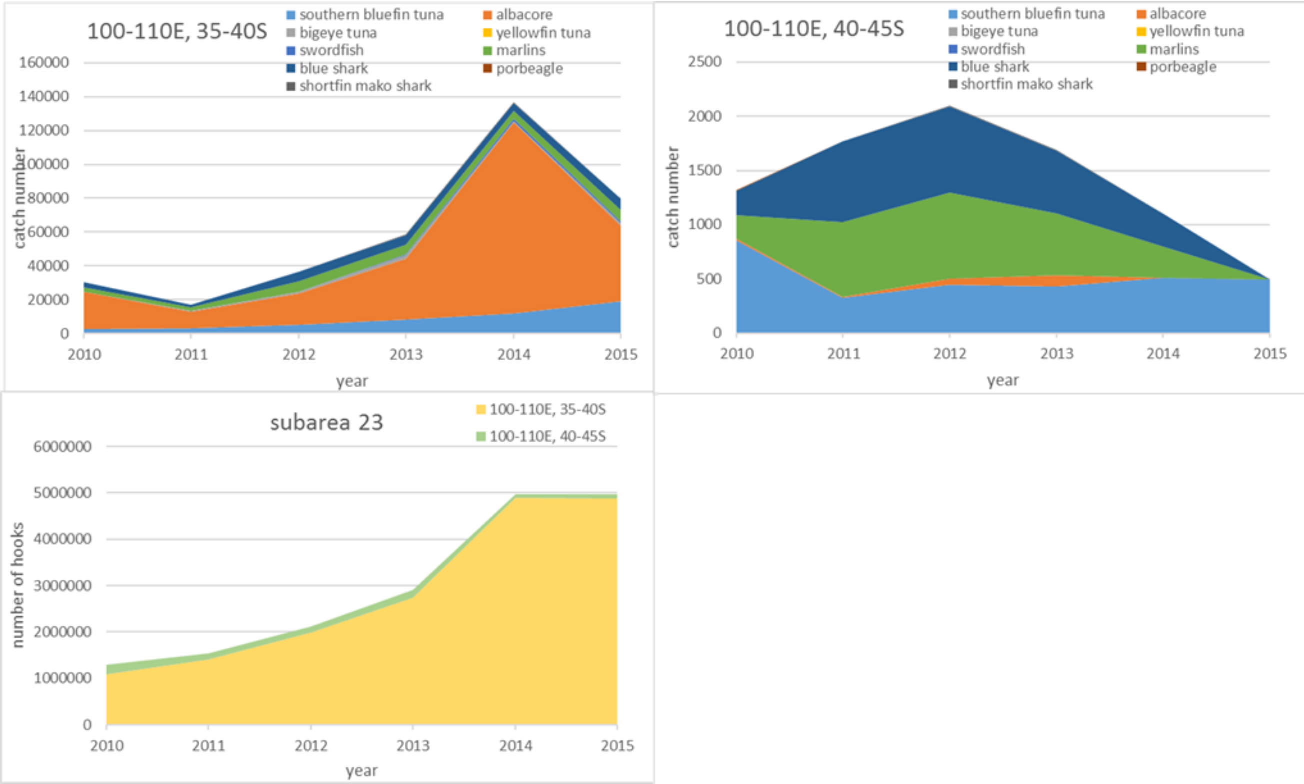

Figure 13: Catch number by species by 5 degrees' latitudinal band in area 23 of Japanese longliners during 2010 – 2015 (upper two panels), and amount of effort by 5 degrees' latitudinal band in area 2 (lower panel).

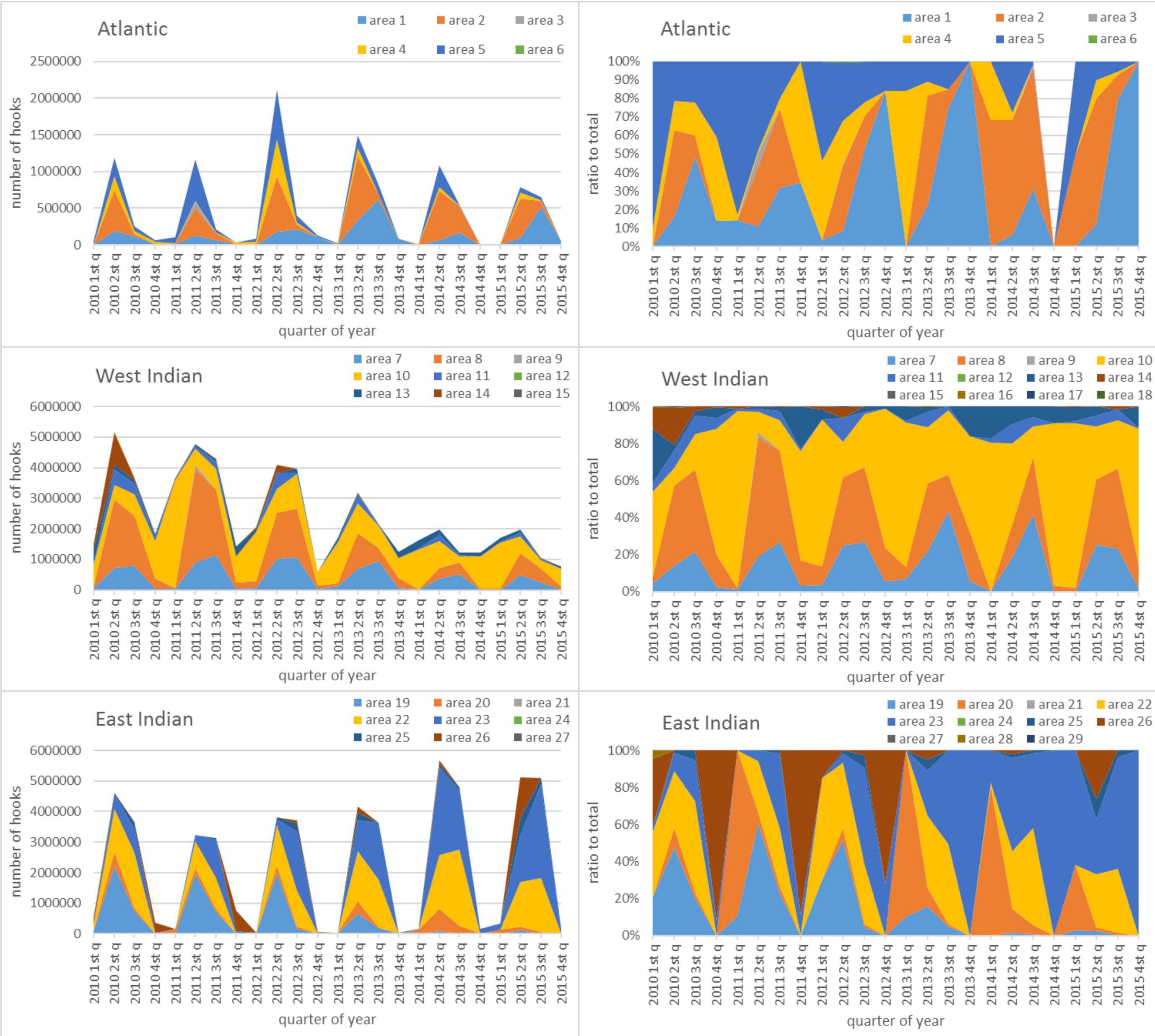

Fig. 14: Amount of effort by area and by quarter (left row) and ratio of amount of effort by area and by quarter (right row) of Japanese longliner operated in the Atlantic Ocean (top panels), the west Indian Oceans (middle panels) and the east Indian Ocean (bottom panels) during 2010 – 2015.