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The operation pattern of Japanese tuna longline fishery with the information for prefecture of vessels register and reporting rate in the North Pacific Ocean, 1994-2010

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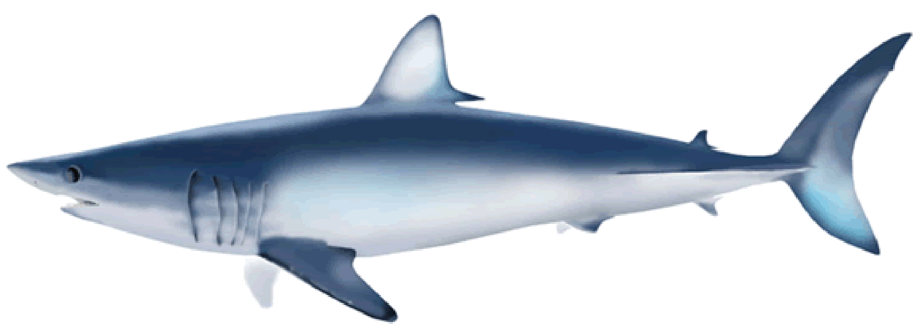

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Summary

To examine whether the existing filtering methods are applicable in the Pacific Ocean or not, number of operations and catch number of major fish species are compared by fleet type (*Kinkai* or *Enyo*), region or prefecture of vessel register, gear configuration, reporting rate and area. More than 96% of all blue shark catch during 1994 to 2010 are caught by *Kinkai* fleet based on Tohoku & Hokkaido region. Concentration of high blue shark catch are found in areas 1 and 2 and caught by both *Kinkai* and *Enyo* fleets. In contrast, the longline sets conducted in areas 3, 5 and 6 are mainly using deep gear and targeting tunas. It is found that different patterns of reporting rate by region or prefecture of vessel register. Whereas a large number of sets conducted by Tohoku & Hokkaido fleets showed 100% reporting ratio of sharks regardless of fleet type and gear configuration, some fleets based on part of other prefectures report zero shark catch in the most of their sets regardless the area they deployed. Thus it is considered that these fleets dose not usually retain all of their shark catches. Because most of deep sets in areas 5~7 classified into low reporting rate category, it could indicate that the abundance of commercially valuable sharks are relatively low in these areas. Also this indicates that the existing filtering method which applying a single reporting rate (equal to or larger than 80 % or greater than 95%) would induce over evaluation of blue shark catch, because such high reporting ratio would only be obtained by the sets with extreme high shark catches in some areas . Therefore new filtering method should be applied. The results of present study suggest that the catch and effort data of Tohoku & Hokkaido fleets in areas 1, 2, 5 and 6 except 0% reporting rate can be a base information to analyze catch and effort data of Japanese longliners for their use of stock assessment of blue shark in the North Pacific Ocean.

Introduction

The filtering method using reporting rate (percentage of sets with shark catch per one cruise) has been considered to be necessary for estimating to extract data used for the standardized CPUE of sharks because of several common problems with the shark catch data. Firstly the log-book reporting system of Japanese longline fishery had possessed only data of "species combined shark catch" before 1994, secondly the logbook data of the pelagic shark species does not include the information of dead discards and live releases. In the Atlantic

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Ocean, the CPUEs of pelagic sharks were analyzed using data filtered by the reporting category (Nakano and Honma, 1996; Shiode and Nakano, 2001), then Nakano and Clark (2006) proved that the data of only blue shark catch was successfully extracted when the data was filtered by the criteria of higher than 80% of reporting ratio by comparing observer data to log-book data. Because these results were only confirmed for the data set in the Atlantic Ocean, it should be analyzed that this method is acceptable in the North Pacific Ocean where many fleets conduct shallow sets and seasonally targeting blue shark. In this report, the number of operations and the catch number of major fish species are compared by fleet type (*Kinkai* or *Enyo*), region or prefecture of vessel register in which owner companies of longline boats are based on, gear configuration, reporting rate and area.

Material and Methods

The Japanese longline logbook data during 1994 to 2010 were used in this study, especially set by set catch and effort data with the information for the fleet type (Kinkai or Enyo) and region or prefecture in which controlling companies of fleets are based on. The data for 2009 and 2010 are provisional.

- the *Kinkai* (offshore) fleet is defined as the vessels between 20 and 120 MT
- the *Enyo* (distant water) fleet is the defined as the larger than 120 MT

The Japanese prefectures are shown in Fig. 1. There were many sharks process factories in Kesennuma city, Miyagi prefecture so that many longline boat based on Kesennuma fishing port targeting sharks are belonging Miyagi or surrounding prefectures. As the preliminary analysis, the operation pattern of longline boat registered in each prefecture was .conducted. Then prefectures whose longliners had the same operation patterns as Miyagi fleets were selected and these prefectures (Hokkaido, Aomori, Iwate, Fukushima and Toyama) were classified as Tohoku & Hokkaido fleets (Fig. 1). Also some other prefectures which had larger number of longline boats were selected to compare their operational pattern with Tohoku & Hokkaido fleets. The areas used for this analysis are shown in Fig. 2.

The reporting rate (percentage of operations with shark catch to total sets per one cruise) was calculated using the same equation as Nakano and Clark (2006). The reporting rate was classified by every 10% bins, including 0 % and 100 % as independent classes. Number of

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hooks between floats (NH) was classified as shallow (3-6 NH) and deep (7-40 NH). The number of sets and shark species composition were calculated and compared by fleet type and by area.

Result and Discussion

Both *Kinkai* and *Enyo* fleets registered to Tohoku & Hokkaido have conducted huge amount of operations for both shallow and deep gear in the North Pacific Ocean (Table 1). The total catch number of blue shark caught during 1994 to 2010 are 9,709,409 and 96.5% of them are caught by Tohoku & Hokkaido fleets. In contrast to fleets registered to other prefectures which mainly conduct deep sets, Tohoku & Hokkaido fleets characteristically conduct largest part of shallow sets (84.5% of *Enyo* fleets and 99.1 % of *Kinkai* fleets). There are Oita *Kikai* fleets and Miyazaki *Enyo* fleets which conduct comparatively high amount of deep operations within other prefectures except Tohoku & Hokkaido (Table 1).

In areas 1 and 2 almost shallow sets are conducted by both *Kinkai* and *Enyo* fleets and most of blue sharks are caught in these areas (Figs. 3~6). These catches are made by shallow sets by Tohoku & Hokkaido fleets (Table 1). In contrast, deep operations targeting tunas by *Kinkai* fleet was mainly conducted in area 5, and by *Enyo* fleet in areas 5, 6 and 7 (Figs. 3~6). These tunas catches are obtained by longliners registered in many prefectures including Tohoku &Hokkaido fleets (Table 1). In area 3, small amount of deep operation are conducted and fish catches are decreasing recently (Figs. 3~6). Therefore areas 1, 2, 5 and 6 are considered particularly important areas in the North Pacific Ocean for Japanese longliners because of a great deal of operations and catches for all fishes.

The different patterns of reporting rate by registered region or prefecture of fleets were observed even though they operate in the same area and using the same gear configuration. Figures 7~11 show the shark species composition and number of set by *Kinkai* fleets registered to Tohoku & Hokkaido, Oita and other prefectures, by *Enyo* fleets registered to Tohoku & Hokkaido, Miyazaki and other prefectures in areas 1, 2, and 5~7. Whereas a large number of sets conducted by Tohoku & Hokkaido *Kinkai* fleets showed 100% reporting ratio regardless of fleet type and gear configuration in areas 1 and 2, most of deep sets by fleets based on other prefectures did not report their shark catches at all. Thus it is considered that these fleets do not usually retain all of their shark catches, and their operational or market strategy would be rather different from

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Tohoku & Hokkaido fleets.

It seemed that existing filtering method by Nakano and Honma (1996) and Clarke (2010) which using more than 80% and 94.6 % reporting rate criteria would induce over evaluation of blue shark catch. In areas 5~7, numerous sets by Tohoku & Hokkaido fleets have 0% reporting rate despite these fleets record rather high reporting rate in areas 1 and 2 (Figs 7~11). There would be at least two reasons for this obvious difference. The first reason is the fleet operating in areas 5~7 generally target tunas so most of fishing masters are releasing/discarding their sharks catches. Another is there are actually few shark distributed in these areas. The proportions of blue shark to shark species in areas 5, 6 and 7 are lower than those in areas 1 and 2 (Figs 7~11). It might suggest the low abundance of blue shark in areas 5, 6 and 7.

Nakano (1994) indicated that the high abundant areas of blue shark in the Pacific Ocean were 35N to 45N from the results of variety of research operations by drift net and longline. In addition, Matsunaga et al. (2005) analyzed the data sets obtained from the tuna longline sets conducted by the longline research and training vessels in Japan and made two models for standardizing CPUE of blue shark in northwestern Pacific Ocean. This study reported that GLM analysis indicated relative low CPUEs on the north side of study area and those low CPUEs were also obtained by the deep gear type. This suggests that the catch ability of deep sets on blue shark is rather lower than the ones of shallow sets. Therefore the observed many sets of lower reporting categories in areas 5 and 6 is considered to be caused by the combination of the relatively low abundance of blue shark in these tropical areas and deep gear configuration in there. It might be possible to estimate blue shark catches excessively in some areas with low abundance but large efforts when these catches are estimated using only data of high reporting ratio. Kleiber et al. (2009) applied existing reporting rate filter of 80% to obtain data of Japanese longliners used for stock assessment of blue shark in the North Pacific Ocean. The higher amount of catch from deep longline than shallow longline reported by this study should be revisited. Further investigations of spatiotemporal pattern of blue shark could improve the precision of stock assessment.

The data set of Tohoku & Hokkaido fleets except 0% reporting rate record could offer base information for stock assessment without removing much information of distant water fleets. Though it is impossible to distinguish between 0% reporting rate caused by low abundance from by release/discard, Tohoku & Hokkaido fleets remains not negligible operations in wide areas even after removing 0% reporting rate operations. This strongly indicates the fact that Tohoku & Hokkaido fleets constantly retain their catch of commercially valuable sharks like blue shark under certain fixed condition. Moreover Tohoku & Hokkaido data set are considered relatively reliable unlike Miyazaki or Oita as mentioned above. If only high reporting rate filter were applied for Japanese commercial longline, selected information would only be available in areas 1 and 2 but almost data would be removed in areas 5~7. Clark et al. (2011) analyzed the north pacific shark data. The reporting rate filter, which removes data from vessels with average reporting rates lower than 94.6%, were applied to individual vessel. This criterion was set by the result from research and training vessels on the assumption that these vessels record all their shark catches. Although this assumption is safe and promising, the data from research and training vessels was mainly analyzed to obtain filtering criterion and most of data from commercial longline vessel were removed in the area of 170E to 50W and 20N to 5S. To use the commercial longline data with wider coverage of area and gear type for the stock assessment of shark species, another filtering method would be necessary.

In conclusion, it is suggested that the data set of only Tohoku & Hokkaido fleets in important areas 1, 2, 5 and 6 can be a base for stock assessment of blue shark in the north Pacific. The improvement of existing filtering method to extract high quality shark data based on the findings of this study should largely increase the number and the coverage of data which can be used for the catch and effort analysis of sharks

Reference

Clarke, S., Yokawa, K., Matsunaga, H. and H. Nakano 2011. Analysis of North Pacific Shark Data from Japanese Commercial Longline and Research/Training Vessel Records. WCPFC-SC7-2011/EB-WP-02.

Kleiber, P., Clarke, S., Bigelow, K., Nakano, H., McAllister, M. and Y. Takeuchi 2009. North Pacific Blue Shark Stock Assessment. WCPFC-SC5-2009/EB-WP-01.

Matsunaga, H., Shono, H. Kiyota, M. and Z. Suzuki 2005. Long-term changes in CPUE of sharks and size of blue sharks caught by tuna longline in the western North Pacific Ocean. WCPFC-SC1-2005/EB-WP-11

[1]Working document submitted to the ISC Shark Working Group Workshop, 28 November – 3 December, NOAA Southwest Fisheries Science Center, La Jolla, California U.S.A.
Document not to be cited without author's permission.

Nakano, H. 1994 Age, reproduction and migration of blue shark in the North Pacific Ocean. Bull. Nat. Res. Inst. Far Seas Fish. 31: 141-256.

Nakano, H. and M. Honma 1996. Historical CPUE of pelagic sharks caught by the Japanese longline fishery in the Atlantic Ocean. ICCAT CVSP 46 (4): 393-398.

Nakano, H. and S. Clarke 2006. Filtering method for obtaining stock indices by shark species from species-combined logbook data in tuna longline fisheries. Fish. Sci. 72: 322-332.

Shiode, D. and H. Nakano 2002. Verification of shark CPUE reported by logbook of Japanese longline fishery comparing with the observer data. ICCAT CVSP 54 (4): 1361-1370.

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Table 1. Summary of number of operation and blue shark catch by prefecture or region in 1994-2010. Upper shows *Kinkai* fleets and lower shows *Enyo* fleets.

Kinkai	Number of operations				Number of Blue sharks			
	Shallow (NH<7)		Deep (NH=>7)		Shallow (NH<7)		Deep (NH=>7)	
	N	%	N	%	N	%	N	%
Tohoku&Hokkaido	89,711	99.1	19,242	10.7	7,888,075	99.1	226,781	96.6
Ibaraki	0	0.0	974	0.5	0	0.0	33	0.0
Chiba	112	0.1	1,471	0.8	14,741	0.2	1,475	0.6
Kanagawa	0	0.0	676	0.4	0	0.0	456	0.2
Mie	18	0.0	7,341	4.1	347	0.0	121	0.1
Wakayama	0	0.0	12,380	6.9	0	0.0	991	0.4
Tokushima	12	0.0	14,265	8.0	184	0.0	705	0.3
Kochi	0	0.0	14,127	7.9	0	0.0	2,607	1.1
Oita	49	0.1	82,951	46.3	1,508	0.0	1,229	0.5
Miyazaki	614	0.7	12,898	7.2	54,100	0.7	266	0.1
Yamaguchi	0	0.0	2,106	1.2	0	0.0	0	0.0
Nagasaki	29	0.0	0	0.0	1,276	0.0	0	0.0
Kumamoto	0	0.0	8,798	4.9	0	0.0	25	0.0
Kagoshima	0	0.0	169	0.1	0	0.0	0	0.0
Okinawa	0	0.0	927	0.5	0	0.0	4	0.0
Osaka	0	0.0	861	0.5	0	0.0	117	0.0
Total	90,545	100	179,186	100	7,960,231	100	234,810	100

Enyo	Number of operations				Number of Blue sharks			
	Shallow (NH<7)		Deep (NH=>7)		Shallow (NH<7)		Deep (NH=>7)	
	N	%	N	%	N	%	N	%
Tohoku&Hokkaido	14,866	85.4	167,428	58.9	1,085,294	85.7	170,480	68.8
Ibaraki	128	0.7	981	0.3	14,552	1.1	3,766	1.5
Chiba	1,266	7.3	0	0.0	94,406	7.5	0	0.0
Tokyo	5	0.0	7,748	2.7	0	0.0	2,220	0.9
Kanagawa	0	0.0	13,526	4.8	0	0.0	12,459	5.0
Shizuoka	13	0.1	6,510	2.3	96	0.0	7,080	2.9
Mie	0	0.0	3,763	1.3	0	0.0	5,848	2.4
Wakayama	0	0.0	6,879	2.4	0	0.0	9,296	3.8
Kochi	0	0.0	8,339	2.9	0	0.0	16,974	6.8
Oita	0	0.0	2,853	1.0	0	0.0	0	0.0
Miyazaki	931	5.3	41,974	14.8	60,035	4.7	277	0.1
Akita	0	0.0	87	0.0	0	0.0	0	0.0
Fukui	0	0.0	29	0.0	0	0.0	25	0.0
Fukuoka	205	1.2	1,540	0.5	12,180	1.0	2,147	0.9
Kagoshima	1	0.0	22,442	7.9	0	0.0	17,233	7.0
Total	17,415	100	284,099	100	1,266,563	100	247,805	100

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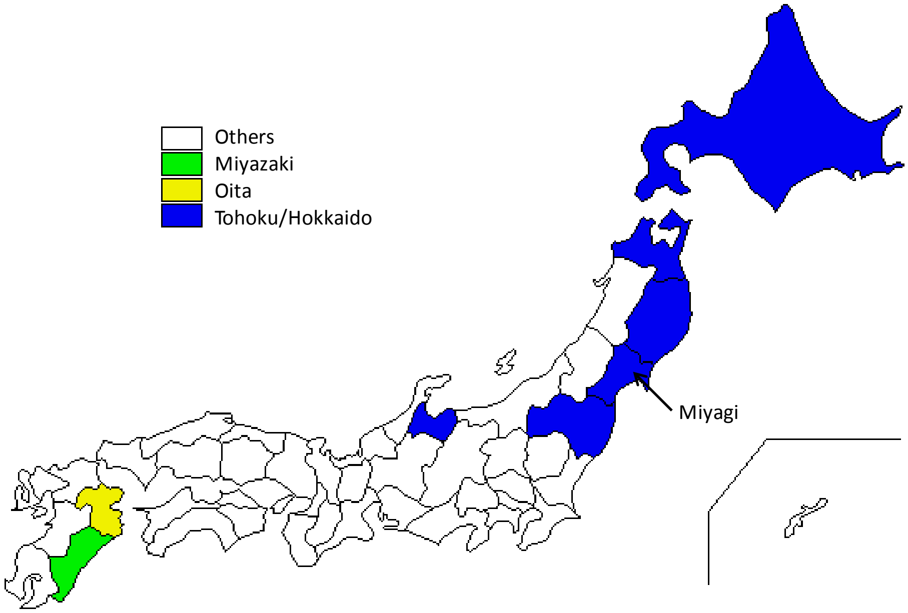

Figure 1 Japanese prefectural border and regional category in this study.

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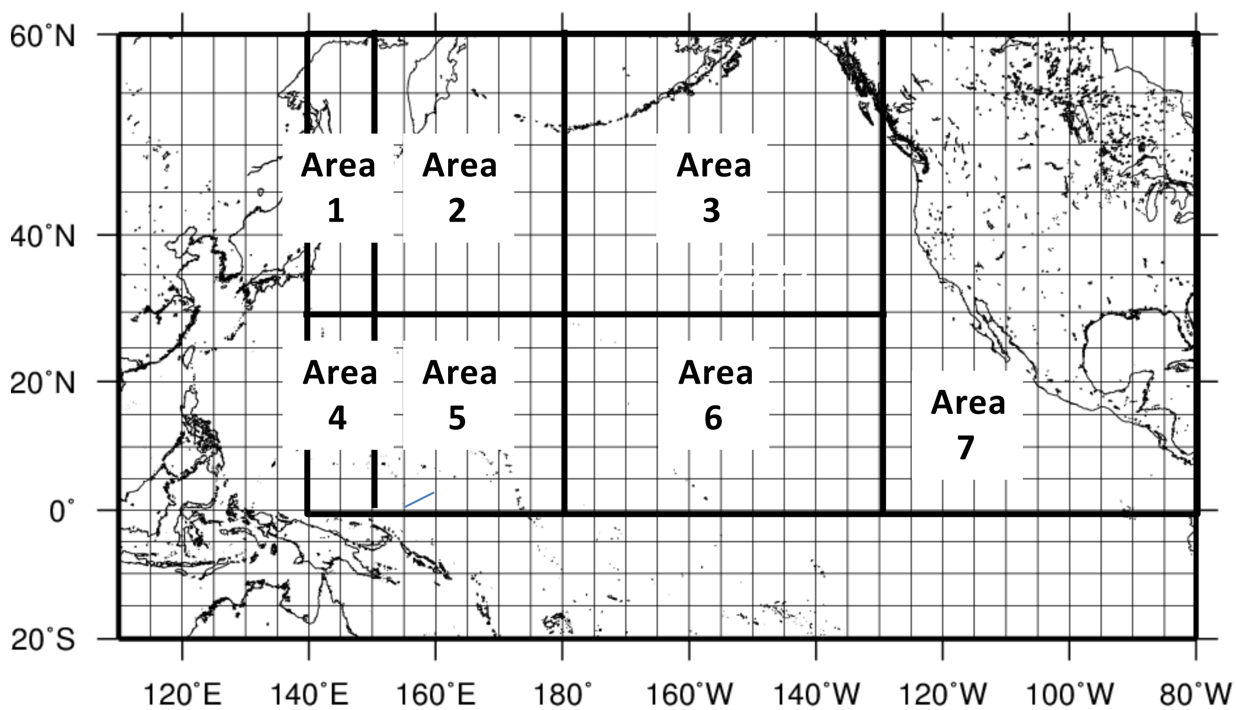

Figure 2 The study area in this study.

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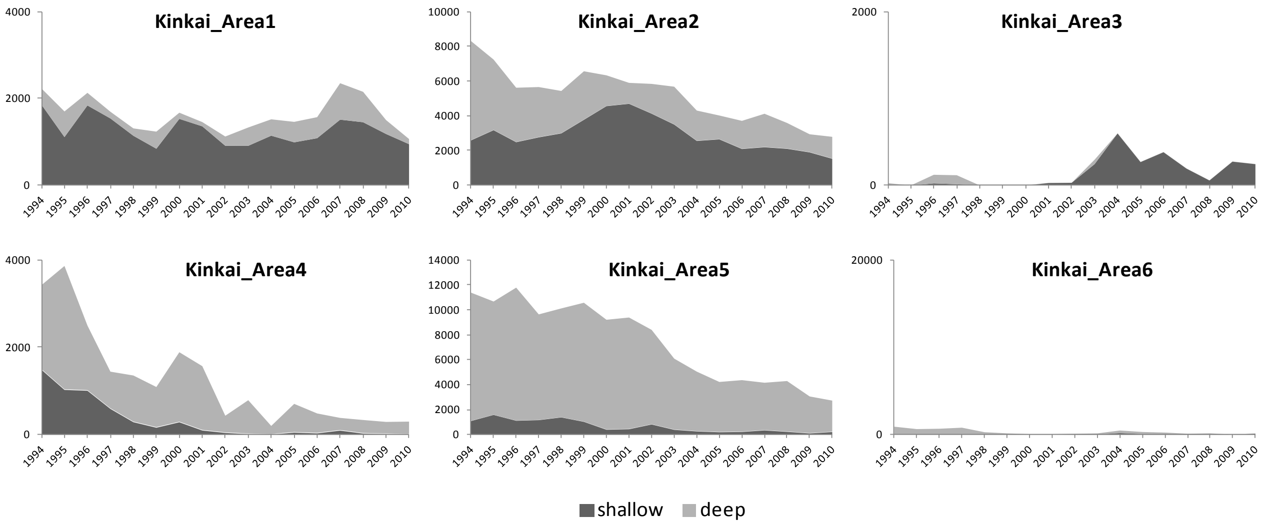

Figure 3 The number of sets by Kinkai fleets by gear configuration (shallow: NH<7, deep: NH <=7) by areas in 1994 to 2010. There were no sets in area 7.

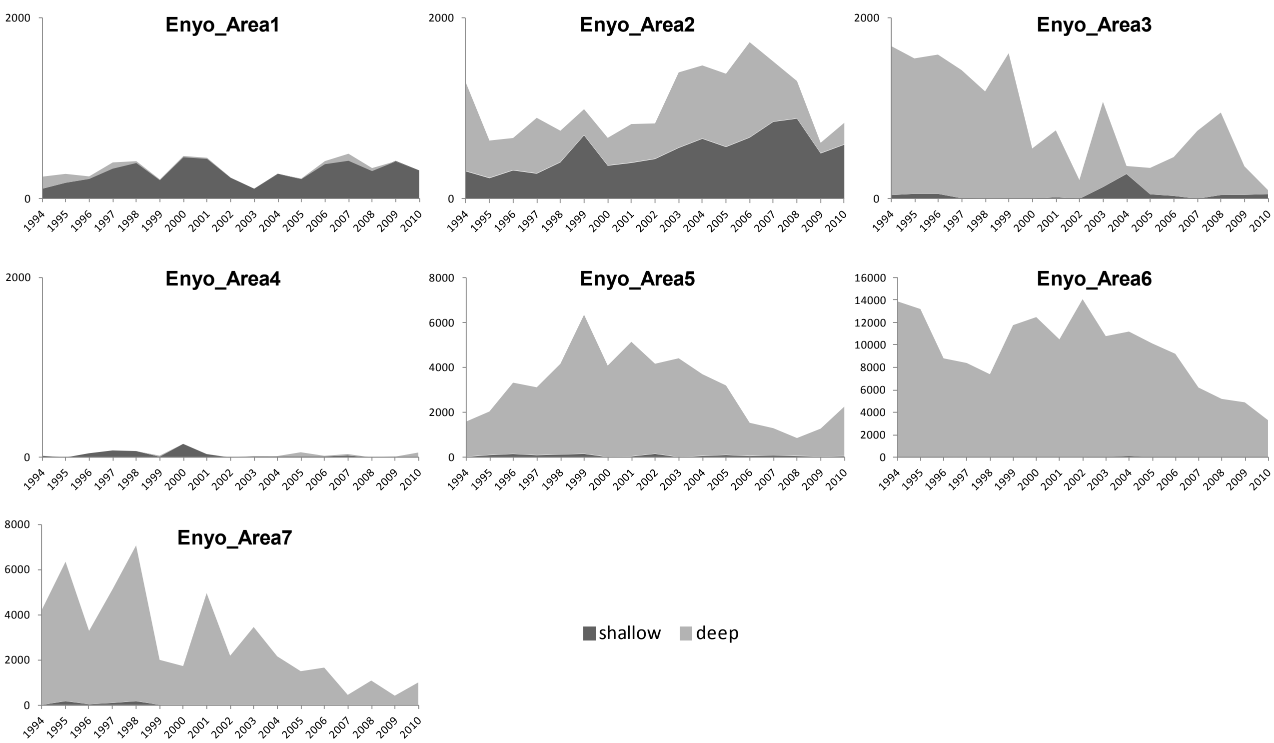

Figure 4 The number of sets by Kinkai fleets by gear configuration (shallow: NH<7, deep: NH<=7) by areas in 1994 to 2010.

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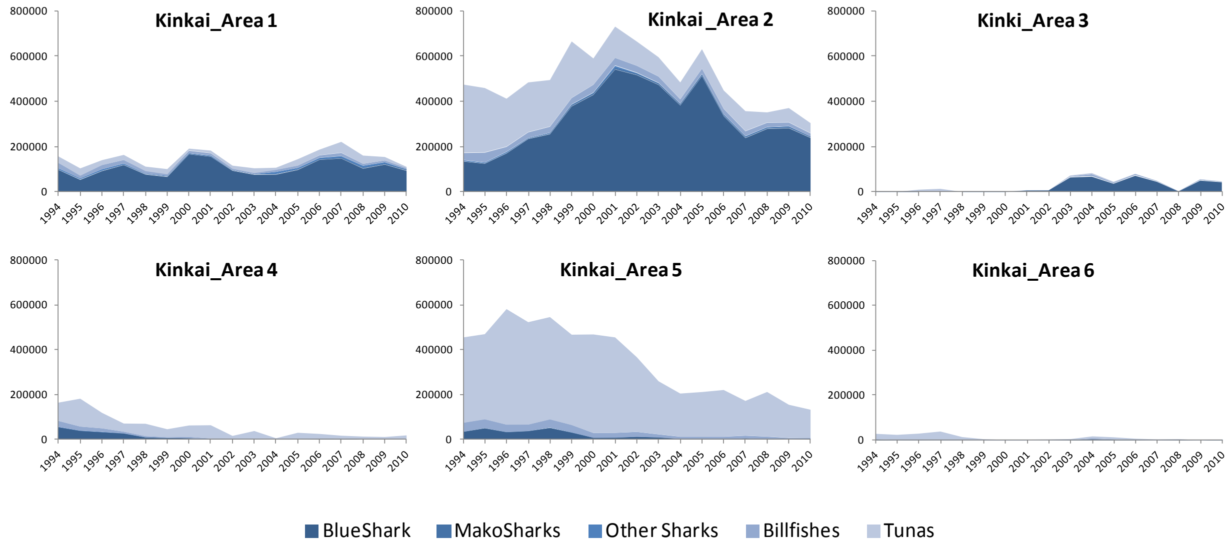

Figure 5 Catch in number of shark species, billfishes and tunas caught by Kinkai fleets by areas in 1994 to 2010. There were no sets in area 7.

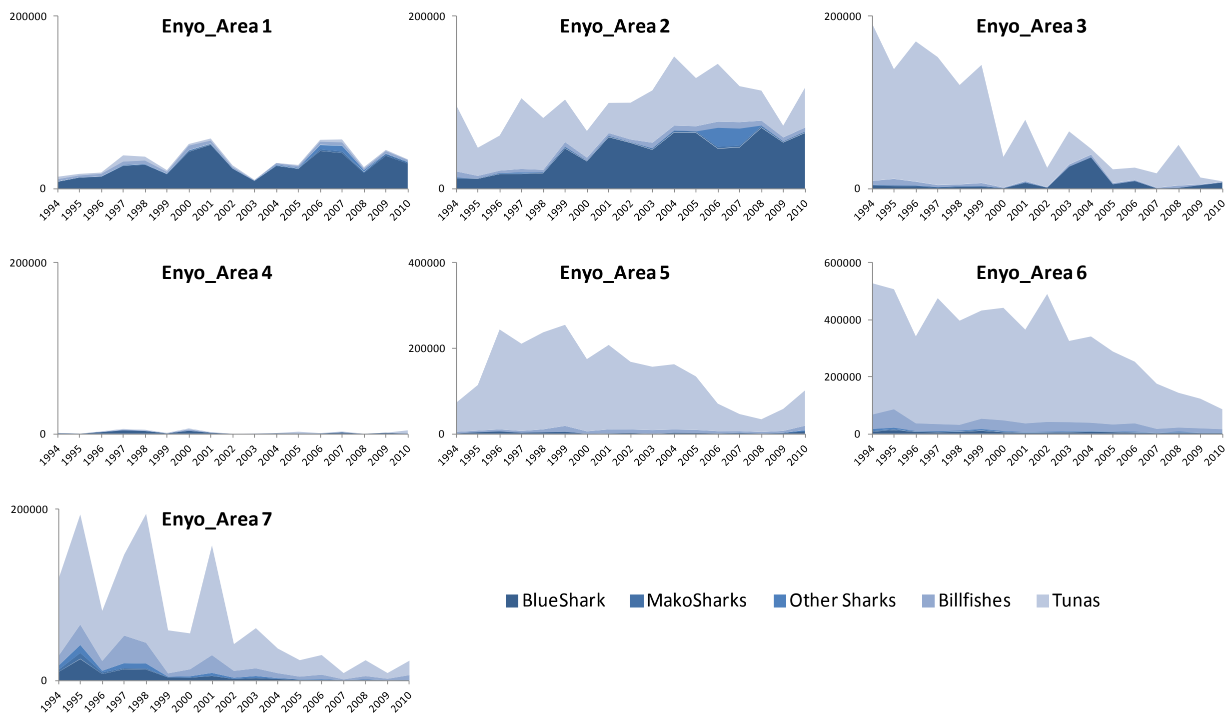

Figure 6 Catch in number of shark species, billfishes and tunas caught by Enyo fleets by areas in 1994 to 2010.

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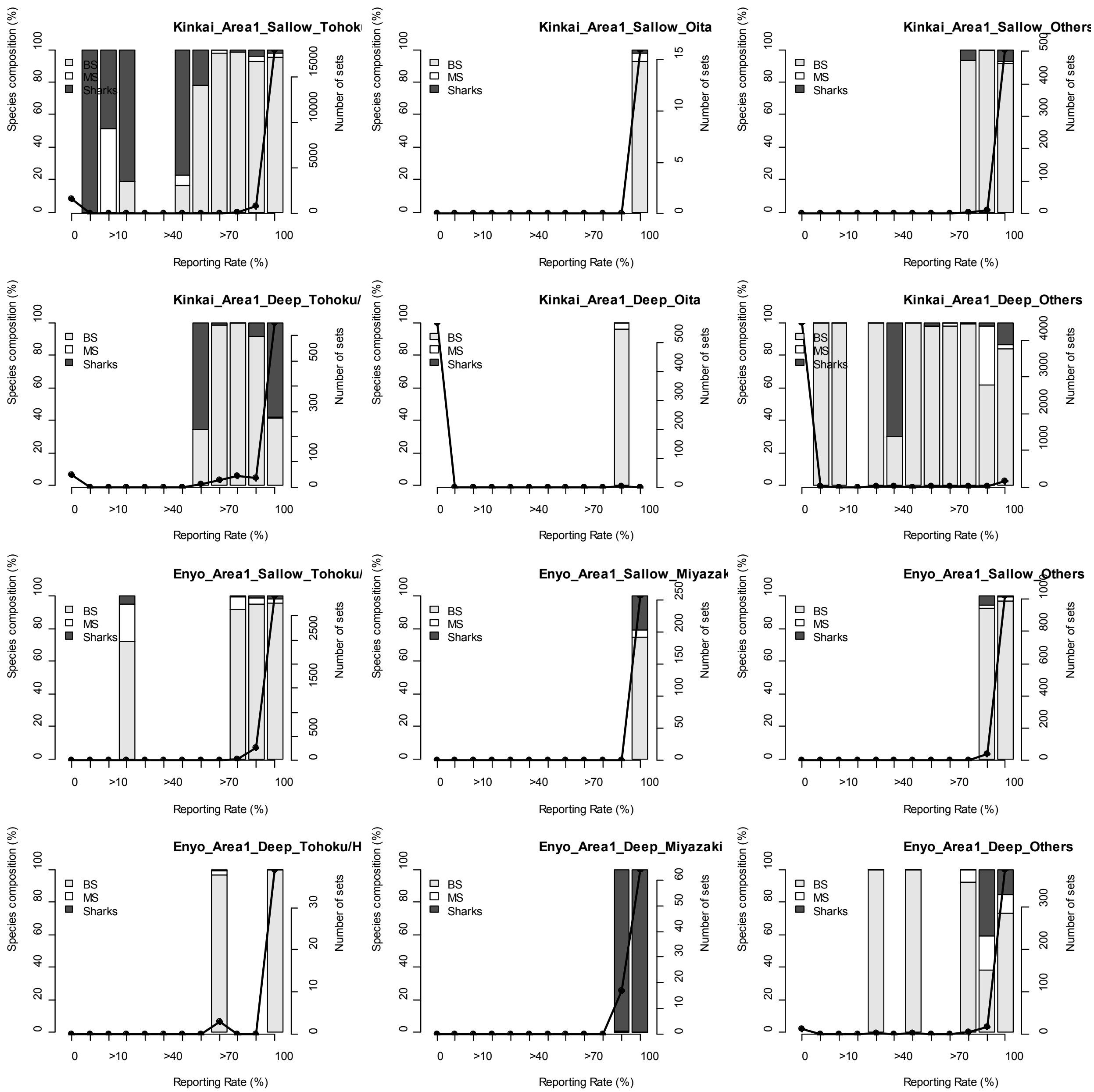

Figure 7. Shark species composition (bar chart; BS: Blue shark, MS: Mako Sharks, Sharks: Other shark species) and number of sets (line graph) by reporting rate categories in area 1. Graphs in upper two rows show the results of *Kinkai* fleets and lower two rows show *Enyo* fleets.

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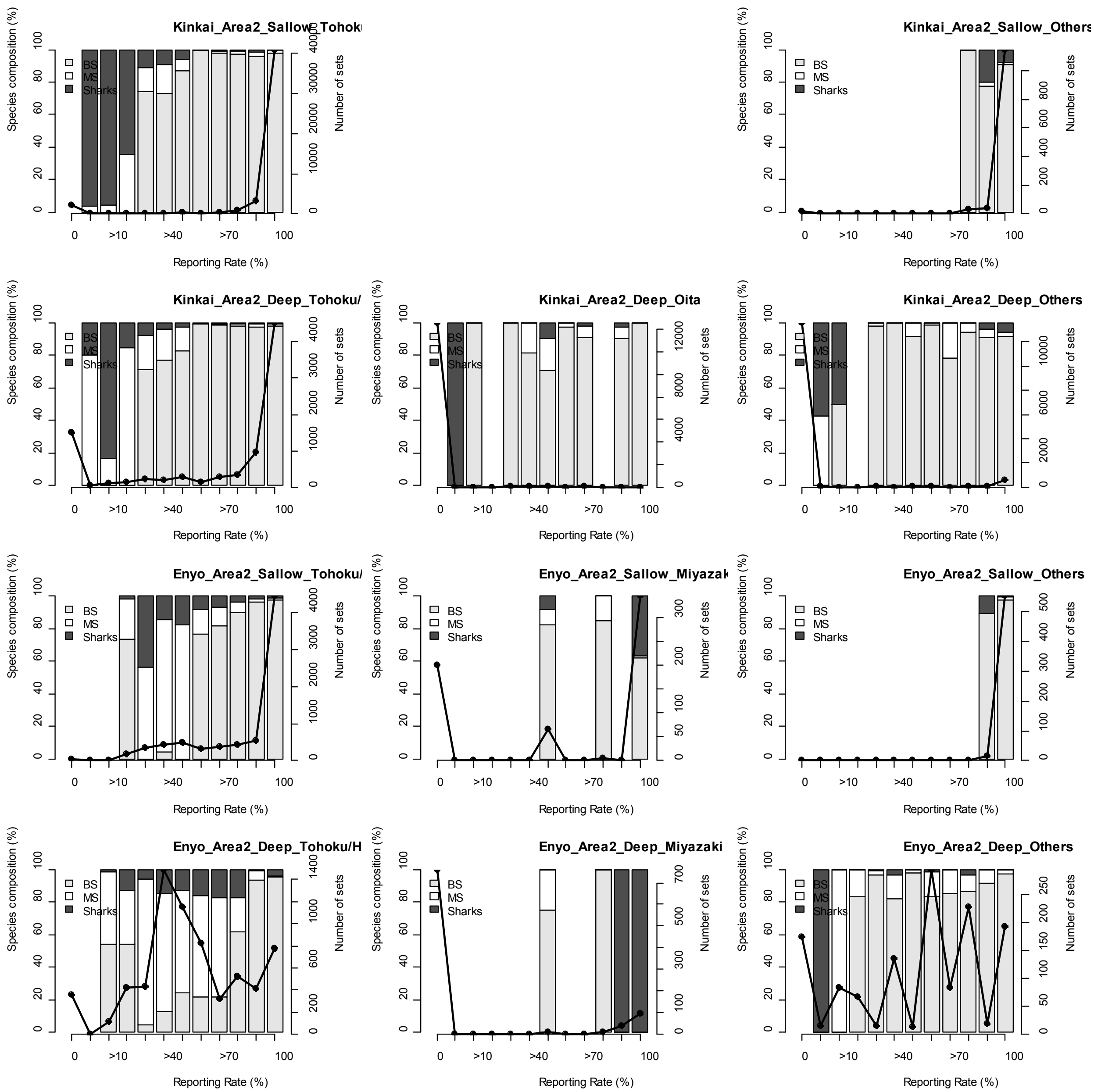

Figure 8. Shark species composition and number of operations by reporting rate categories in area 2. See figure 7 for the legend.

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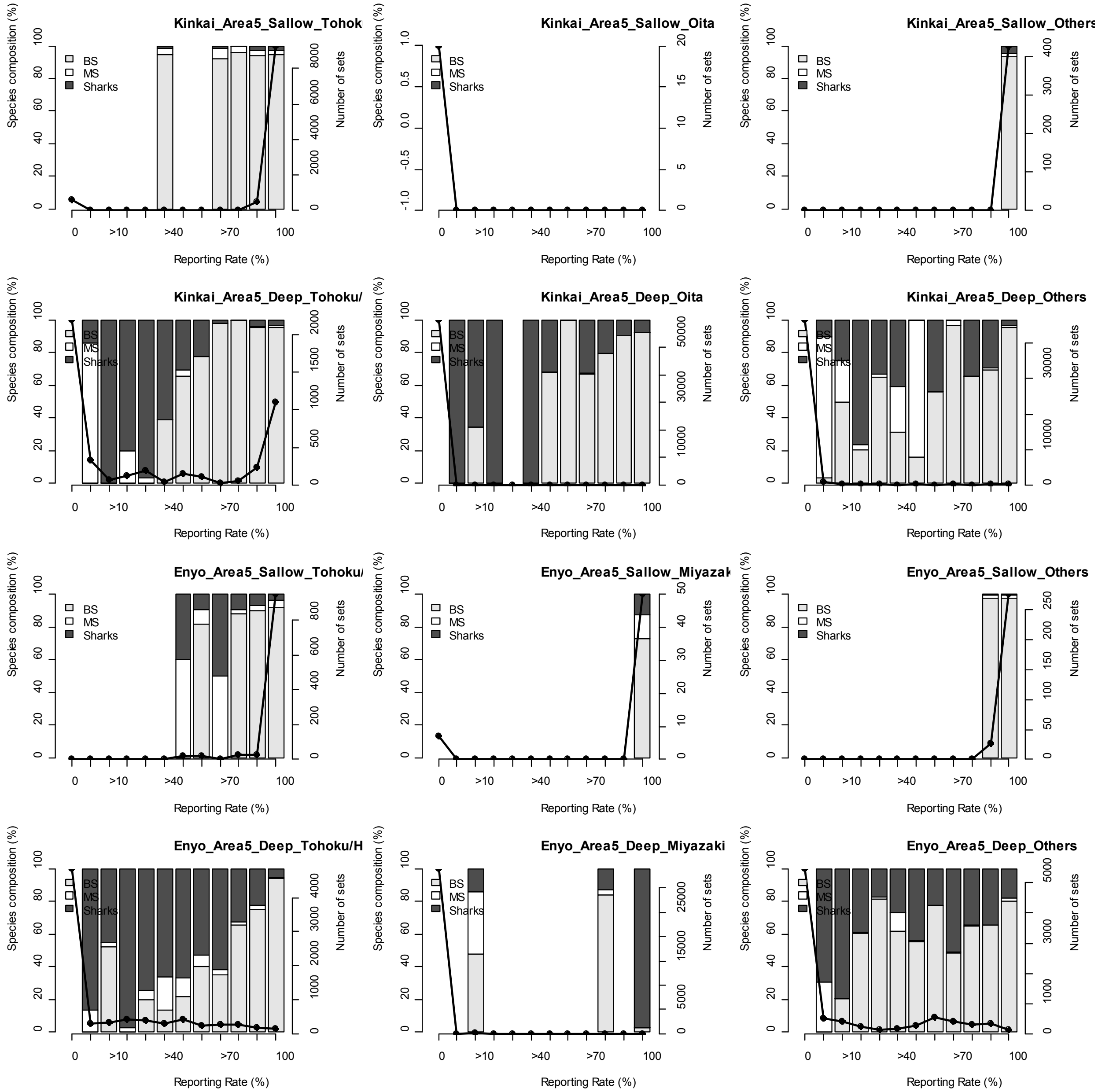

Figure 9. Shark species composition and number of operations by reporting rate categories in area 5. See figure 7 for the legend.

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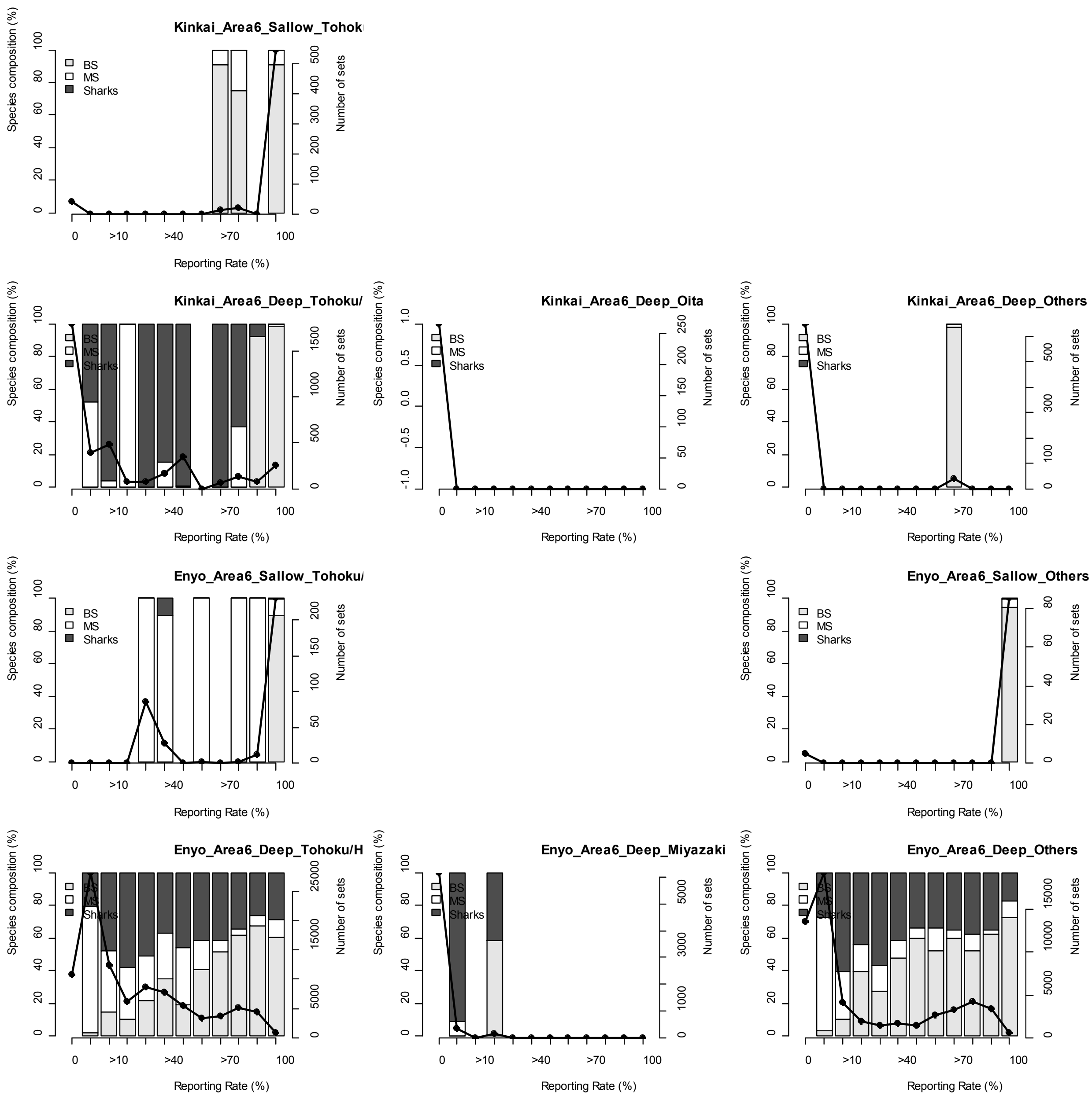

Figure 10. Shark species composition and number of operations by reporting rate categories in area 6. See figure 7 for the legend.

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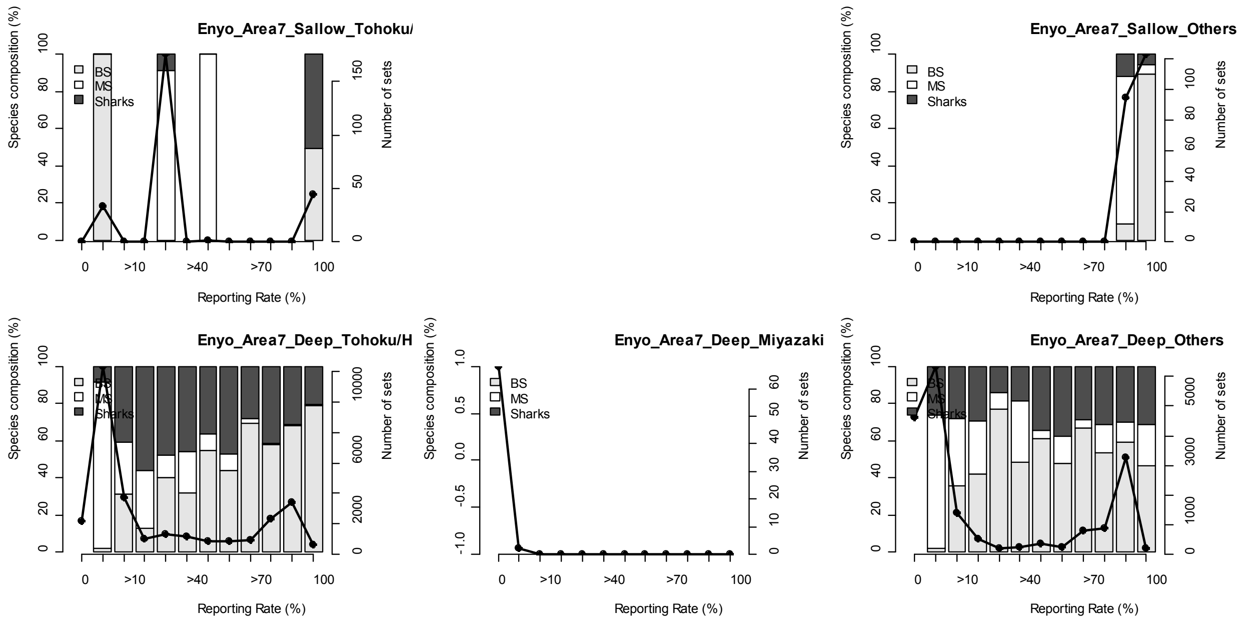

Figure 11. Shark species composition and number of operations by reporting rate categories in area 7. See figure 7 for the legend

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