Analysis of length data of albacore (*Thunnus alalunga*) caught by Taiwanese large-scale longline fishery in the Indian Ocean

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ABSTRACT

In this study, historical length-frequency data of albacore caught by Taiwanese large-scale longline fishery in the Indian Ocean were explored by temporal and spatial factors. A comparison between the data recorded by the logbook data system and the scientific observer program was also conducted. Apparent different length compositions reported by logbook data were observed before and after 2003. sample sizes tended to shift from the western area to the eastern area through the years and the length distributions tended to shift to larger fishes since 2003. The length distributions from logbook data revealed greater variabilities than those from observer data, but systematic differences in the major central and dispersion tendencies by temporal and spatial factors were not significantly identified from the two data sources.

1. INTRODUCTION

IOTC (2019a) indicated that the length distributions of albacore available for Taiwan since 2003 were different than compared to earlier years and further noted that the Taiwanese scientists would continue to investigate the data and the outcomes would be provided for potential use. Following the recommendation from the data preparatory meeting (IOTC, 2019a), stock assessments were conducted analysis runs with and without the Taiwanese size-frequency data pre-2003 (IOTC, 2019b).

In this study, historical length-frequency data of albacore were explored by temporal and spatial factors. In addition, length-frequency data reported with the logbook data system were also compared with those recorded by the scientific

observer program.

2. MATERIALS AND METHODS

The body lengths (fork length) of albacore sampled by fishing sets were recorded with the daily operational catch and effort data (logbook) by 5x5 degree longitude and latitude grid for the Taiwanese large-scale longline fishery from 1980 to 2020. The fork length data of albacore samples were measured by the scientific observers dispatched on the large-scale longline vessels from 2003 to 2020. These data were provided by the Oversea Fisheries Development Council of Taiwan (OFDC). The data reported in the albacore fishing areas (Fig. 1) were used for the analysis in the paper.

3. RESULTS AND DISCUSSION

3.1 Sample size from logbook data

The sample size by year, month, longitude and latitude were shown in Fig. 2. The data were mainly recorded from the fishing sets operated in the SW and SE areas but the sample size obviously fluctuated by years and relative low sample sizes were available from the late 1980s to the late 1990s. Although the sample sizes were substantially increased since the early 2000s, very low data were available in 2003 and 2012. The data recorded in the SW and SE areas from March to September were much more than those in other months when the data were mainly reported by vessels in the NW area. In addition, the data were mainly contributed by the vessels operated in the fishing ground between the longitude of 50°E-90°E and latitude of 35°S-25°S.

Fig. 3 shows the spatial distributions of the sample sizes aggregated by 5 years. The sample sizes obviously decreased in around NW and NE areas from 1985 to 1999 when the overall sample sizes also decreased (Fig. 2). The sample sizes increased and expanded to all areas from 2000 to 2009, but substantially decreased thereafter, especially for the NE area.

Based on annual sample sizes by month, longitude and latitude (Figs. 4-6), the sample sizes by latitude did not reveal obvious patterns since the 1990s, but more data reported from May and June in recent years and sample sizes tended to shift from the western area to the eastern area through the years.

3.2 Length composition from logbook data

The length distributions and compositions by year, month, longitude and latitude were shown in Figs. 7-10. Apparent different length compositions were observed before and after 2003, the length compositions consisted of more fishes with smaller sizes before 2003, while the length distributions tended to shift to larger fishes

thereafter. During the main months from March to September, the body lengths of fishes were obviously smaller than those in other months. The length compositions revealed no obvious patterns by longitude although relatively more small fishes were reported in the waters of longitudes larger than 60°E. However, the body lengths significantly increased from the temperate to tropical waters.

Fig. 11 shows the spatial distributions of the length compositions aggregated by 5 years. The length compositions consisted of more small fishes before the early 2000s, while more large fishes were reported in most of the spatial grids thereafter except for the period of 2005-2009.

3.3 Mean length from logbook data

The annual mean lengths by month, longitude and latitude were shown in Figs. 12-14. The fishes reported from March to September were generally smaller than those in other months, but the mean lengths tended to be larger since the early 2000s. The mean lengths of fishes reported between the latitude of 20°S-10°S were slightly larger than those in previous years. In addition, the mean lengths of fishes reported between the longitude around 40°E-60°E also become larger since the early 2000s.

The spatial distributions of the mean lengths aggregated by 5 years also indicated that the mean lengths of fishes reported in the NW area become larger since the early 2000s (Fig. 15).

3.4 Comparison between logbook and observer data

Fig. 16 shows the spatial distributions of the length compositions from the scientific observer program aggregated by 5 years. Except for 2015-2019, the length data were mainly sampled from the vessels operated in SW and SE areas.

The length distributions between logbook and observer data were compared by year, month, longitude and latitude (Figs. 17-20). Generally, the length data reported with the logbook consisted of much more small and large fishes than observer data. Therefore, the length distributions from logbook data revealed greater variabilities than those from observer data. Although the length distributions from logbook data tended to consist of more large fishes than those from observer data in the waters between 35°E-75°E, systematic differences in the major central and dispersion tendencies by temporal and spatial factors were not significantly identified from the two data sources.

REFERENCE

IOTC (2019a). Report of the Seventh Session of the IOTC Working Party on Temperate Tunas (Data Preparatory Session). Kuala Lumpur, Malaysia, 14–17

January 2019. IOTC–2019–WPTmT07(DP)–R[E]

IOTC (2019b). Report of the Seventh Session of the IOTC Working Party on Temperate Tunas: Assessment Meeting. Shizuoka, Japan, 23–27 July 2019. IOTC–2019–WPTmT07(AS)–R[E]

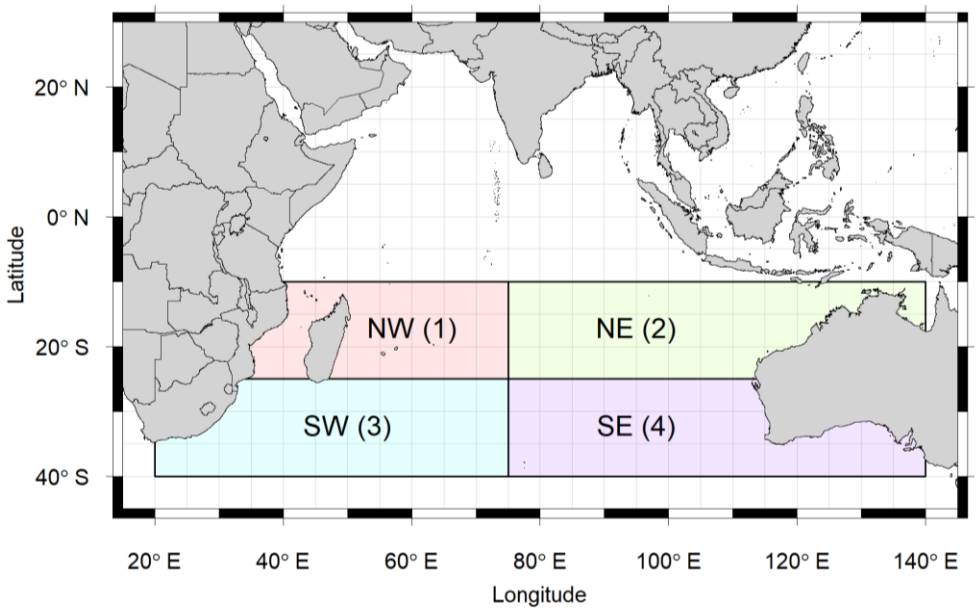

Fig. 1. Area stratification for albacore in the Indian Ocean.

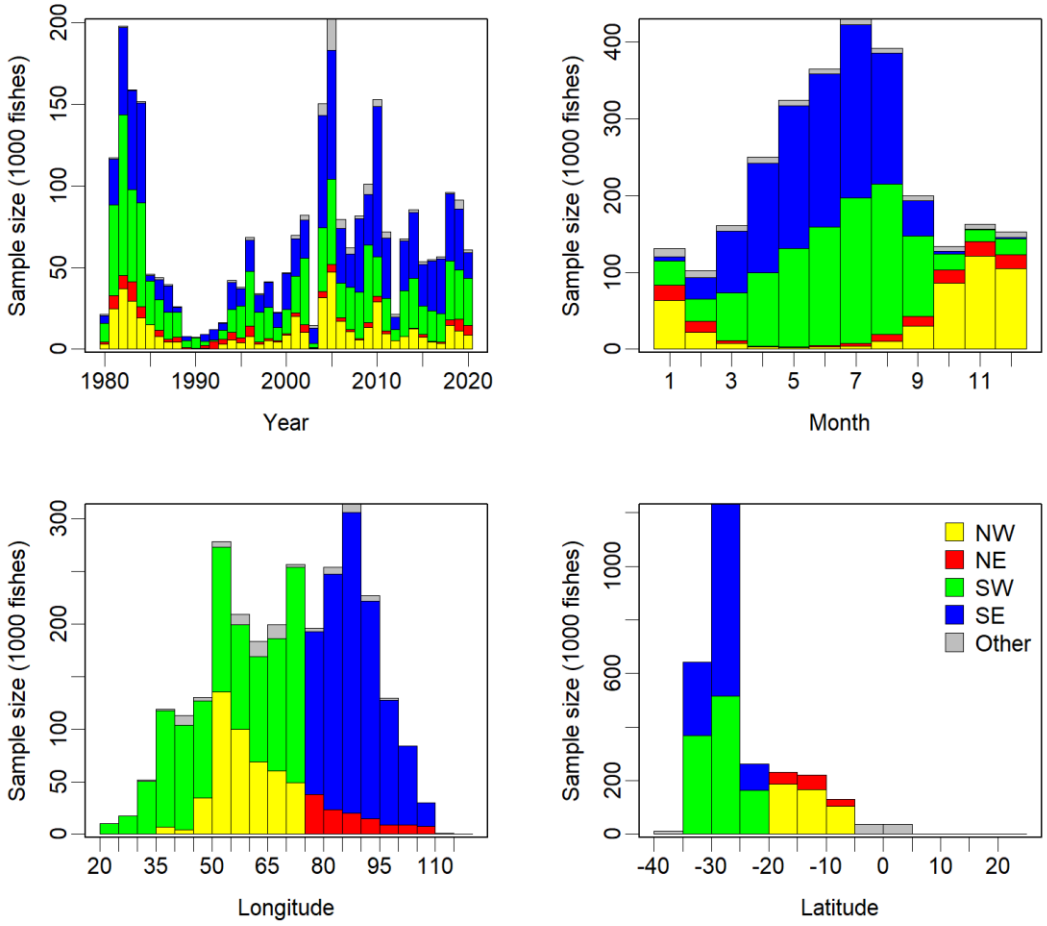

Fig 2. The sample size of length-frequency data grouped by year, month, longitude, latitude and fishing areas for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

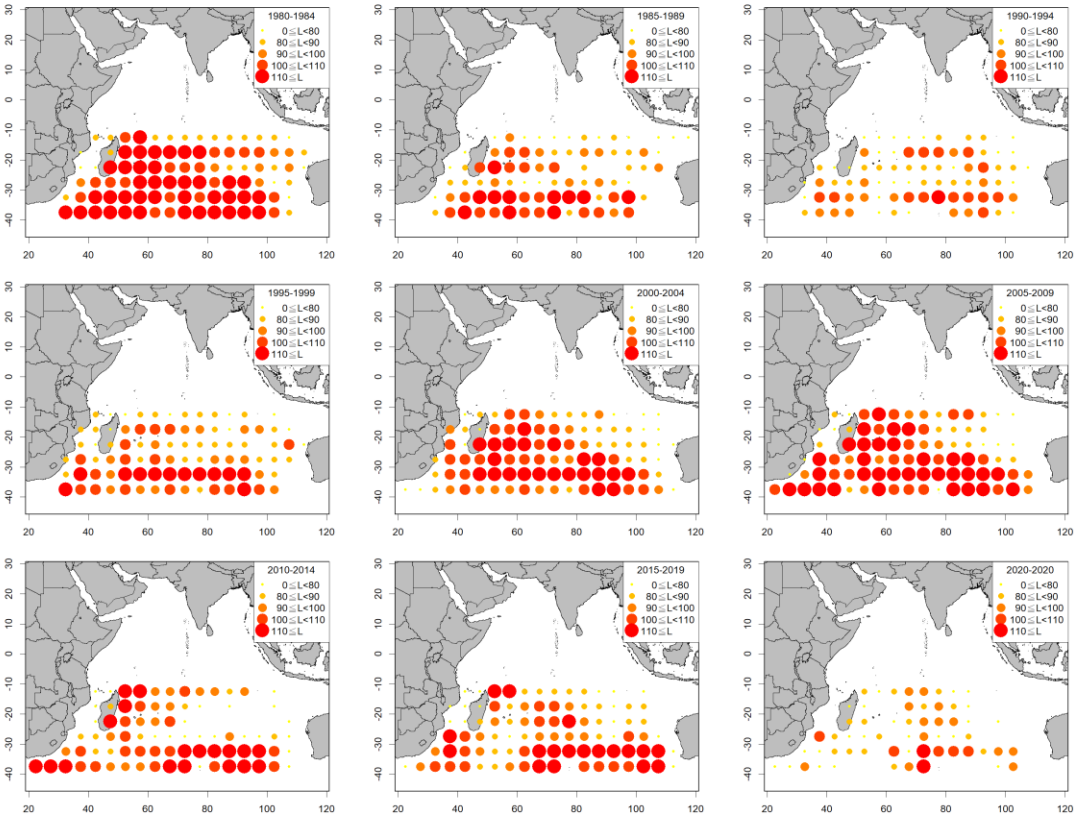

Fig 3. The sample size distributions of length-frequency data for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

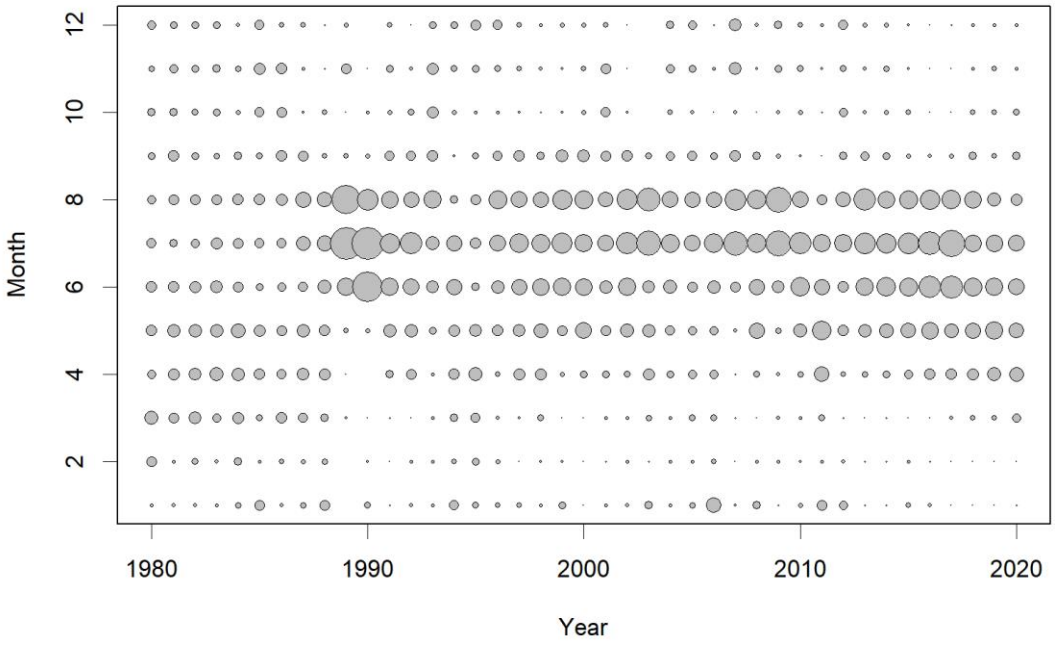

Fig 4. The annual and monthly sample size of length-frequency data for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

Fig 5. The annual and longitudinal sample size of length-frequency data for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

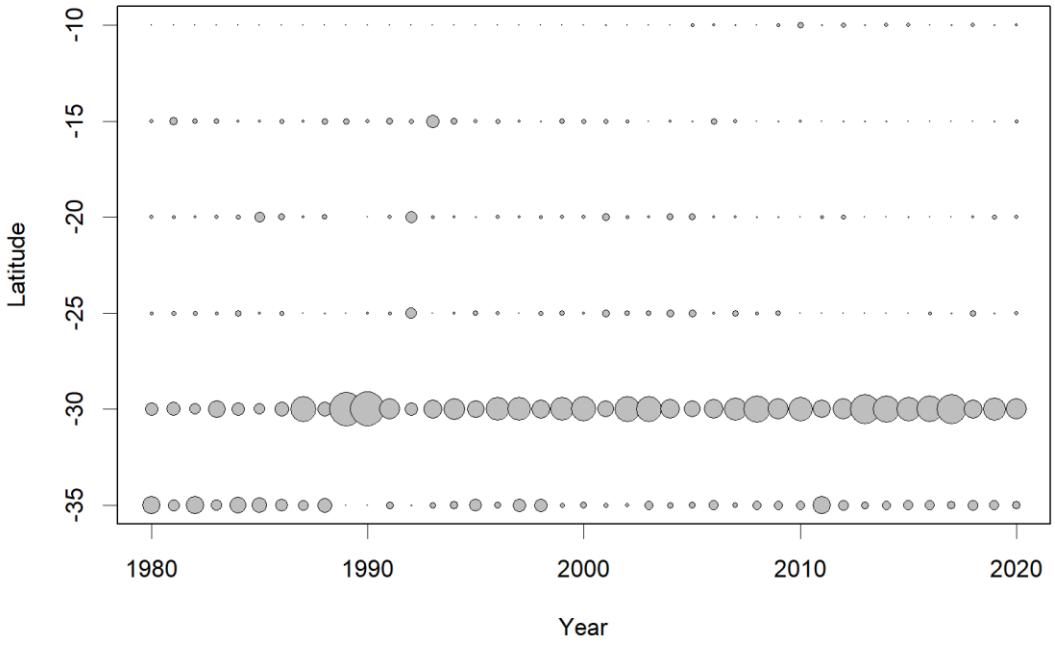

Fig 6. The annual and latitudinal sample size of length-frequency data for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

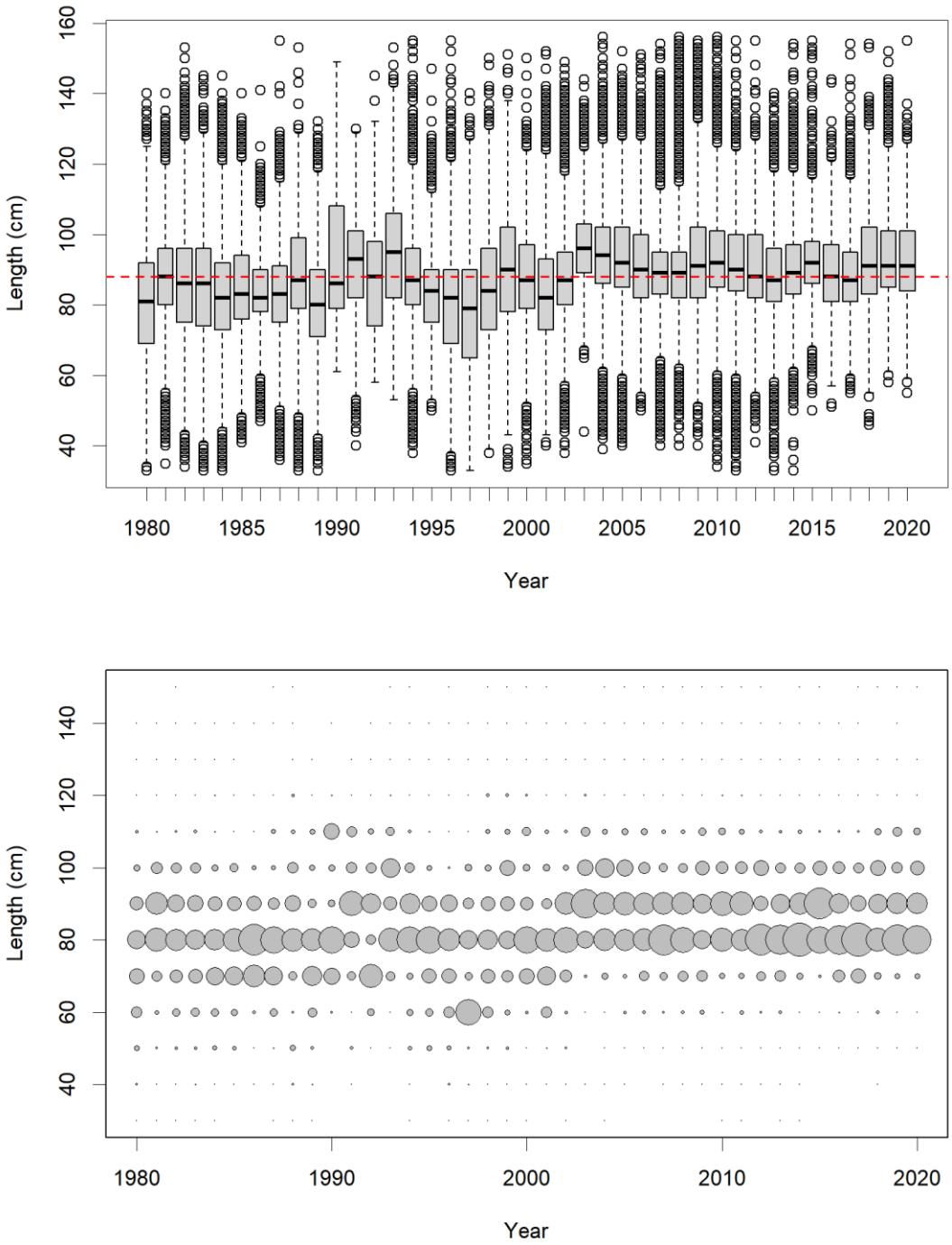

Fig 7. The annual length distributions (upper panel) and compositions (lower panel) for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

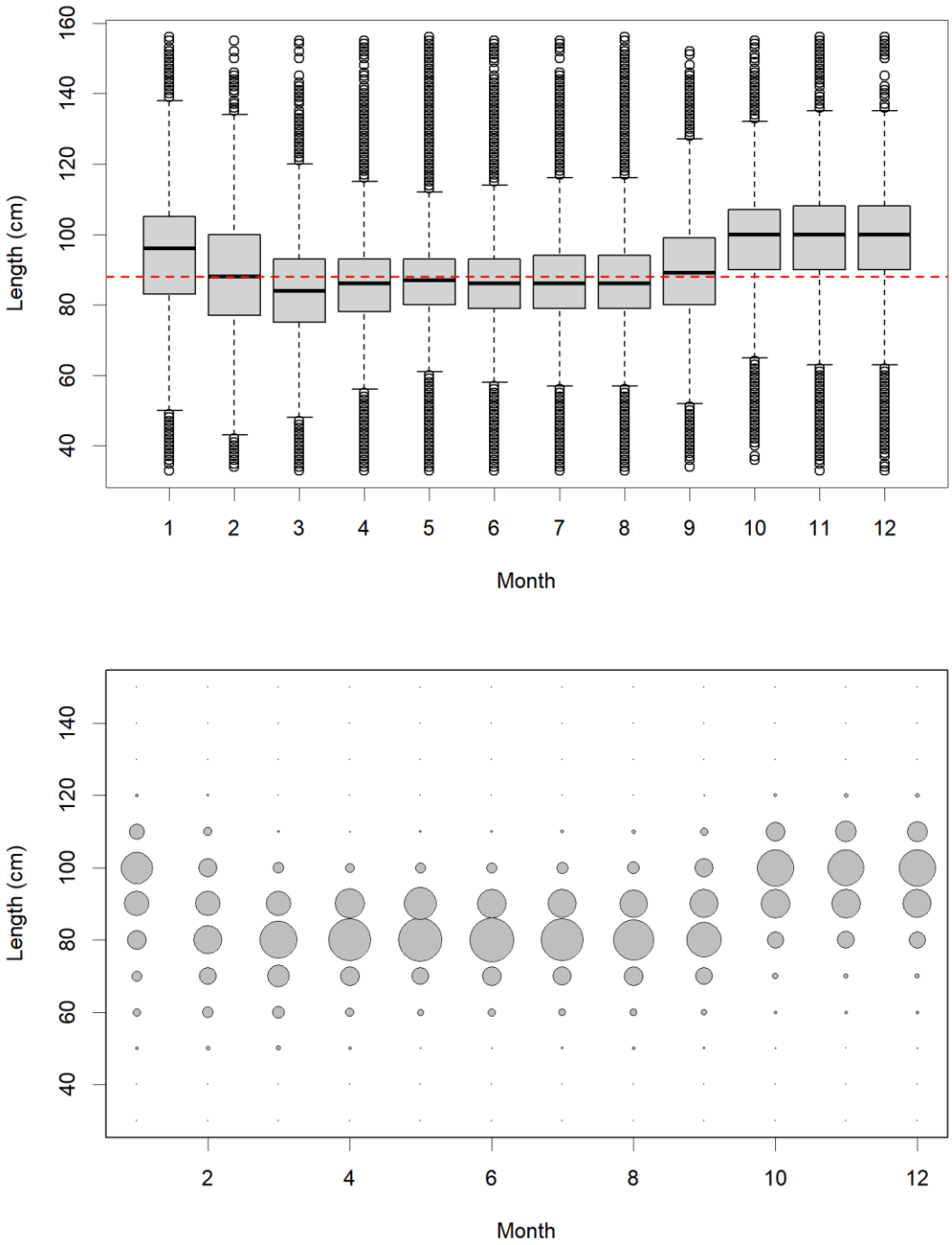

Fig 8. The monthly length distributions (upper panel) and compositions (lower panel) for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

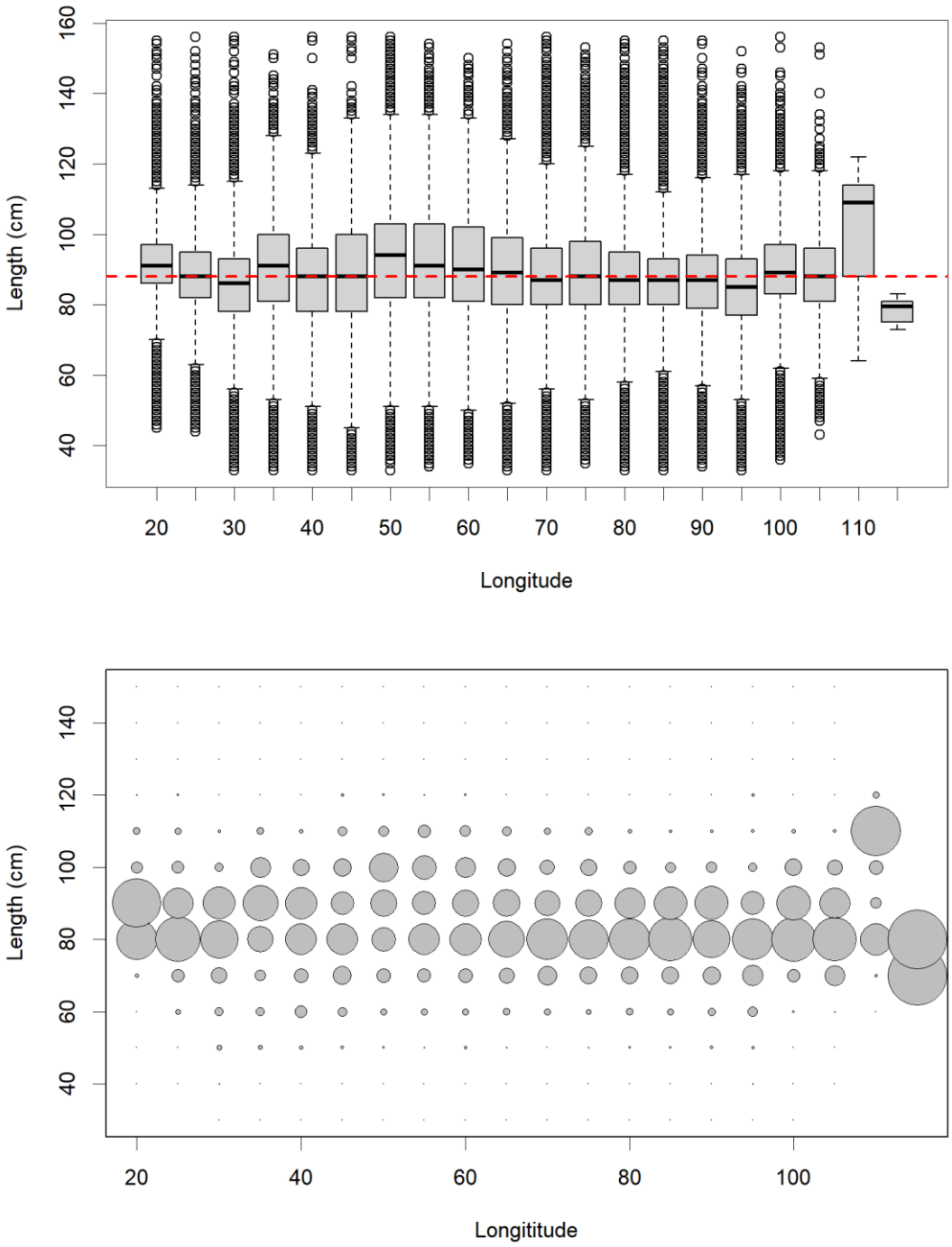

Fig 9. The longitudinal length distributions (upper panel) and compositions (lower panel) for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

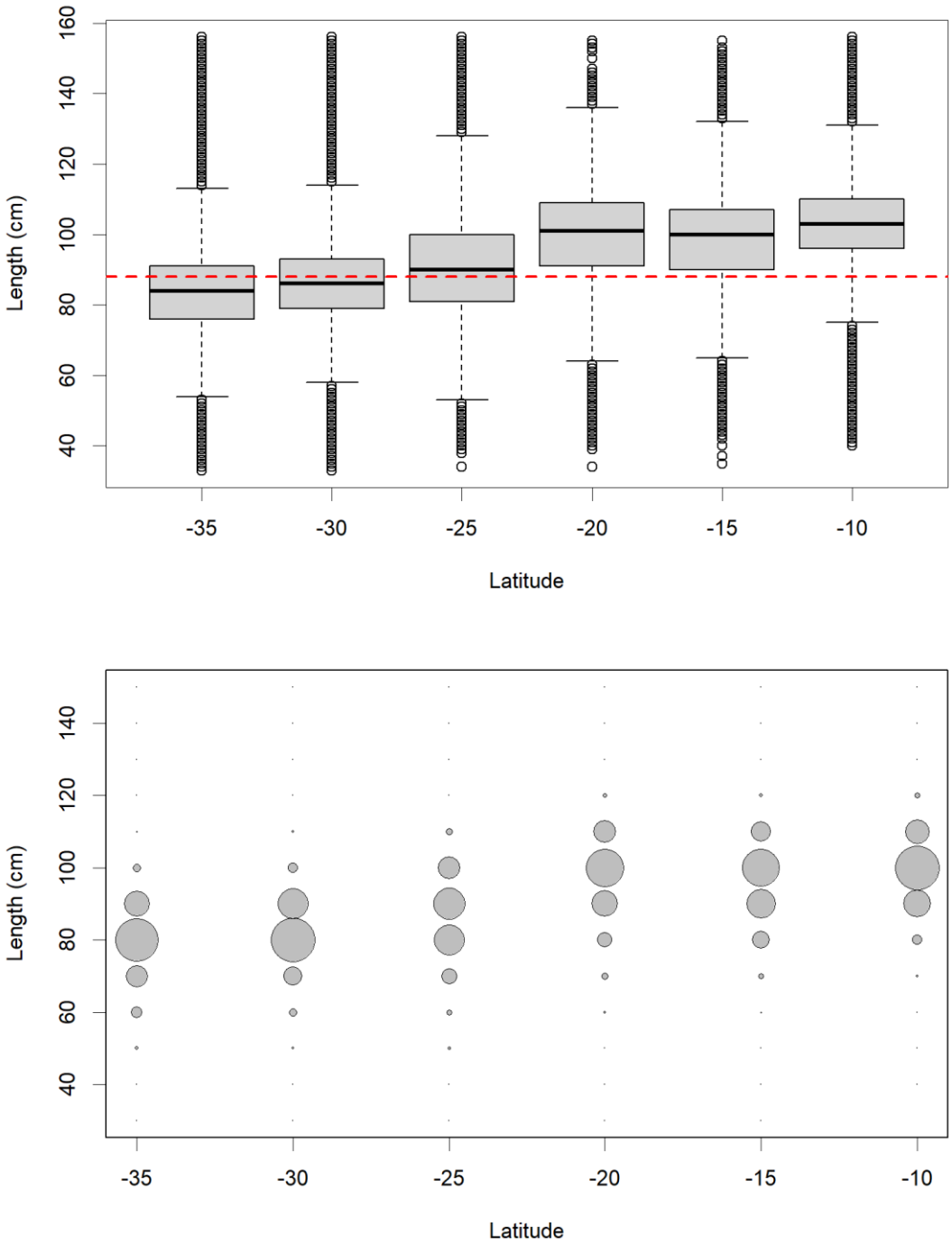

Fig 10. The latitudinal length distributions (upper panel) and compositions (lower panel) for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

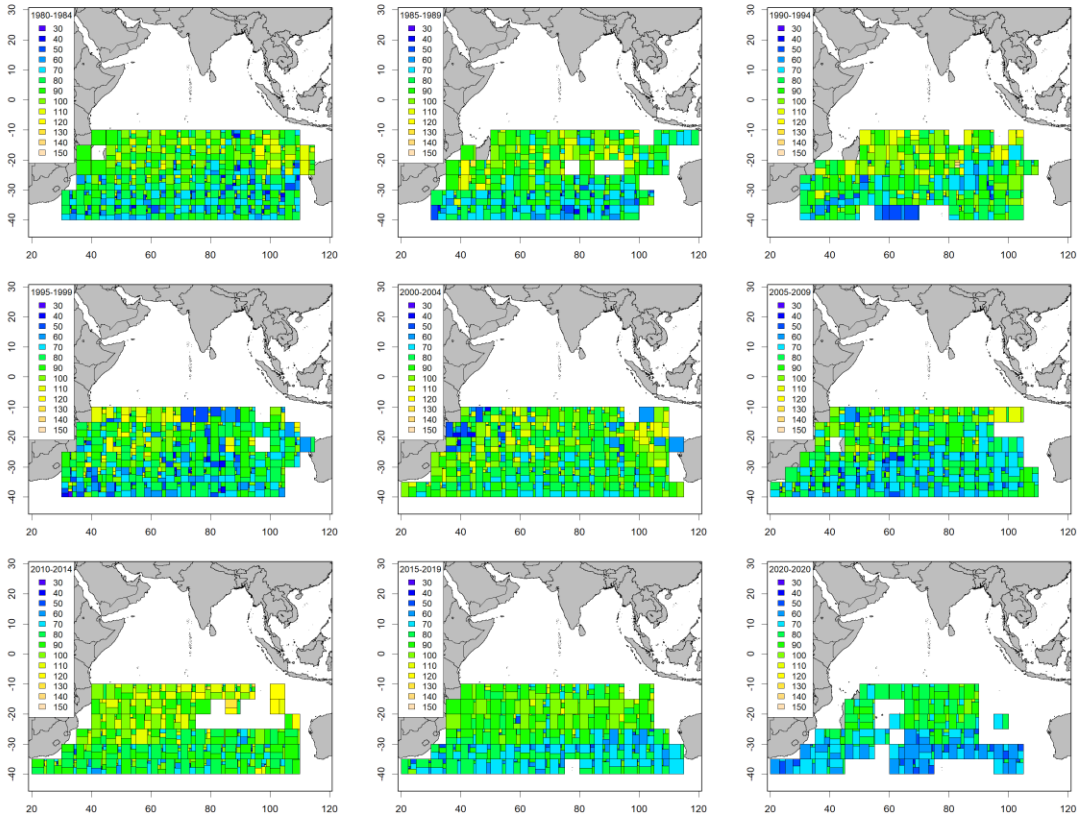

Fig 11. The distributions of length compositions for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

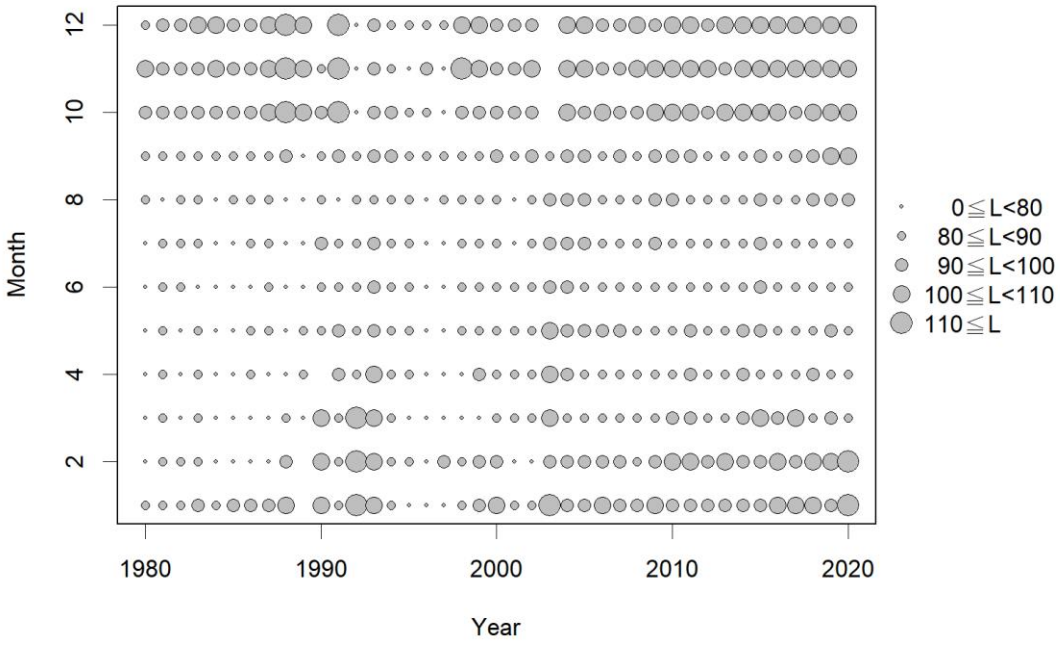

Fig 12. The annual and monthly mean lengths for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

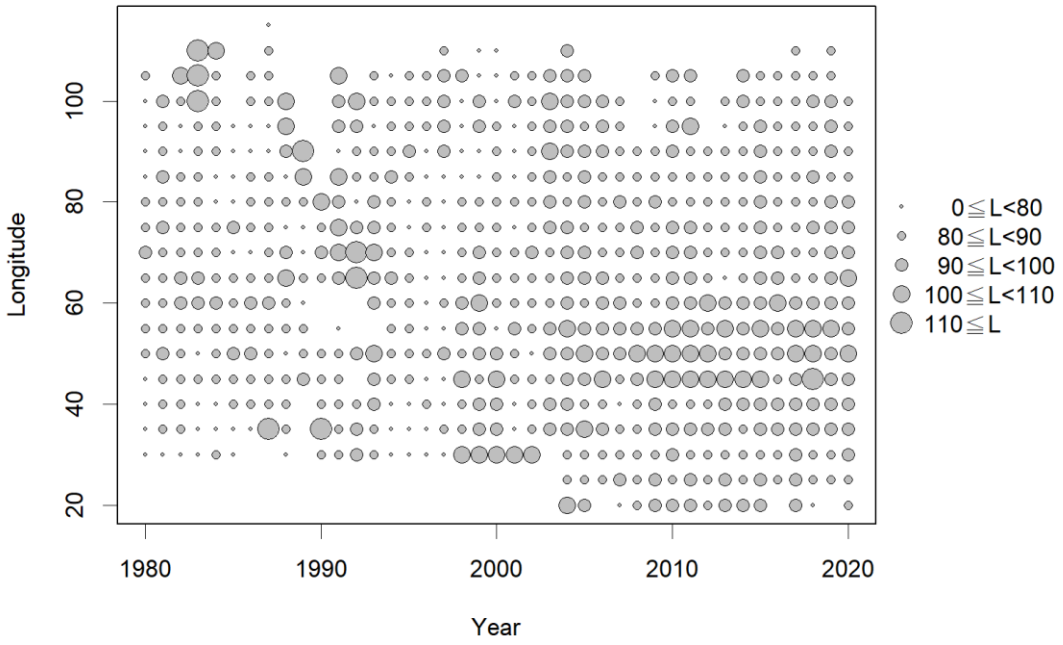

Fig 13. The annual and longitudinal mean lengths for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

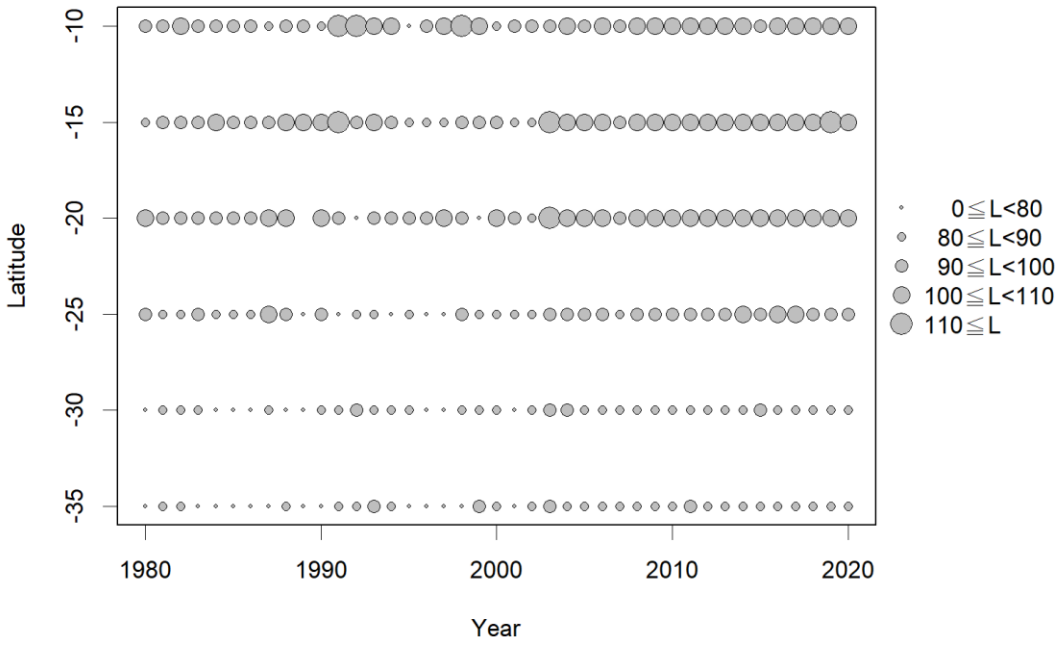

Fig 14. The annual and latitudinal mean lengths for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

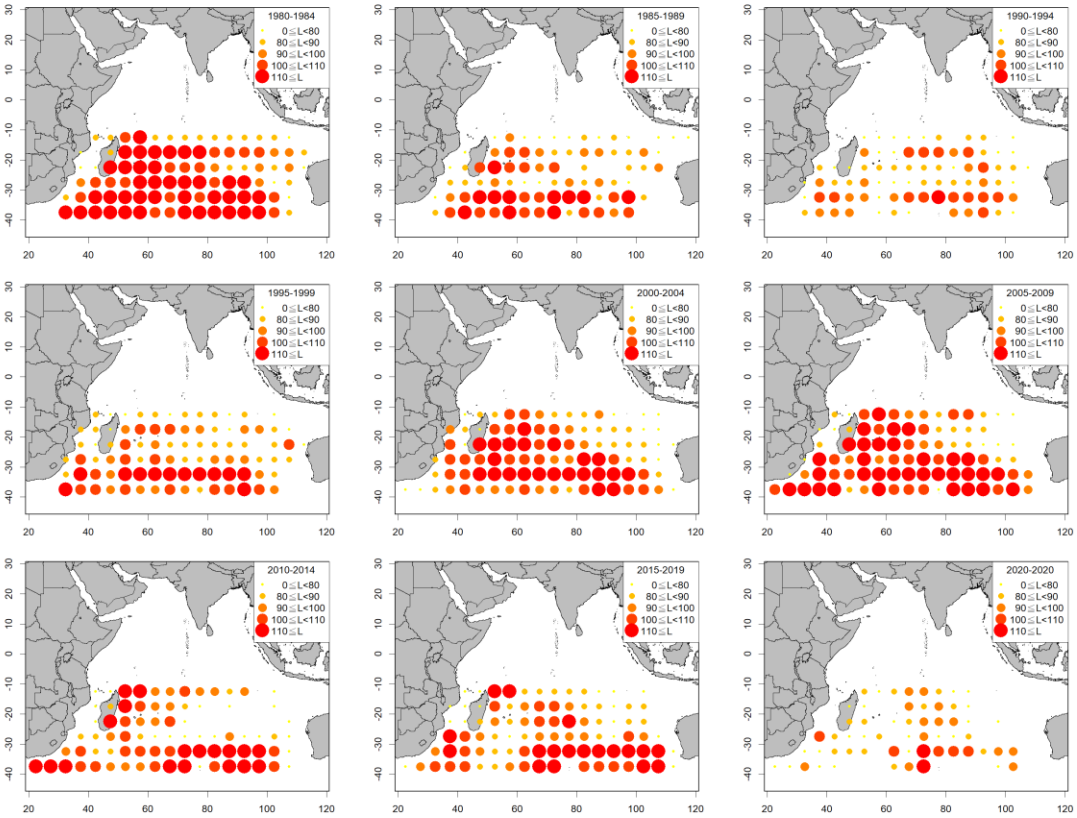

Fig 15. The distributions of mean lengths for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

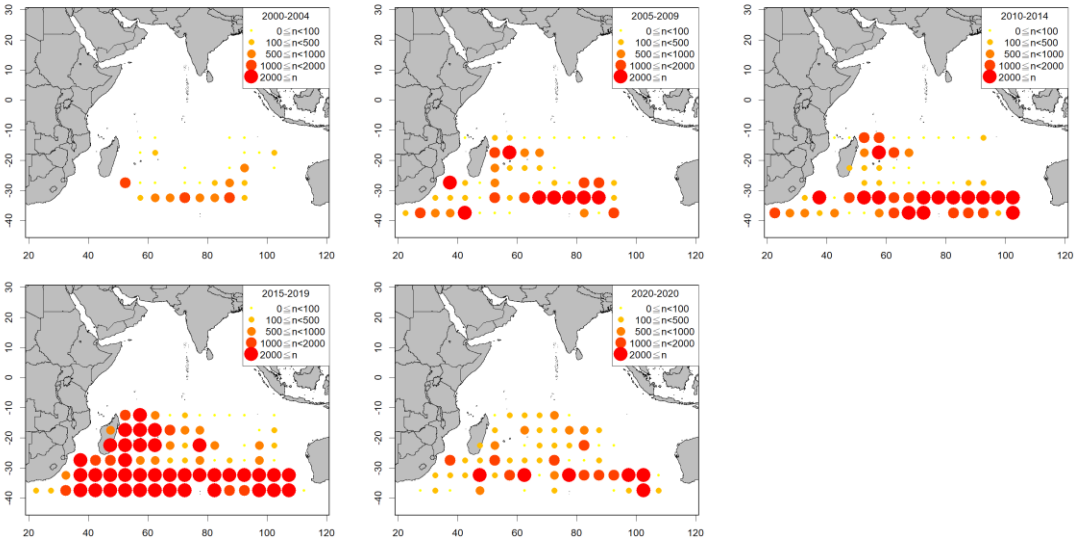

Fig 16. The sample size distributions of length-frequency data for albacore reported by Taiwanese large-scale longline fishery in the Indian Ocean.

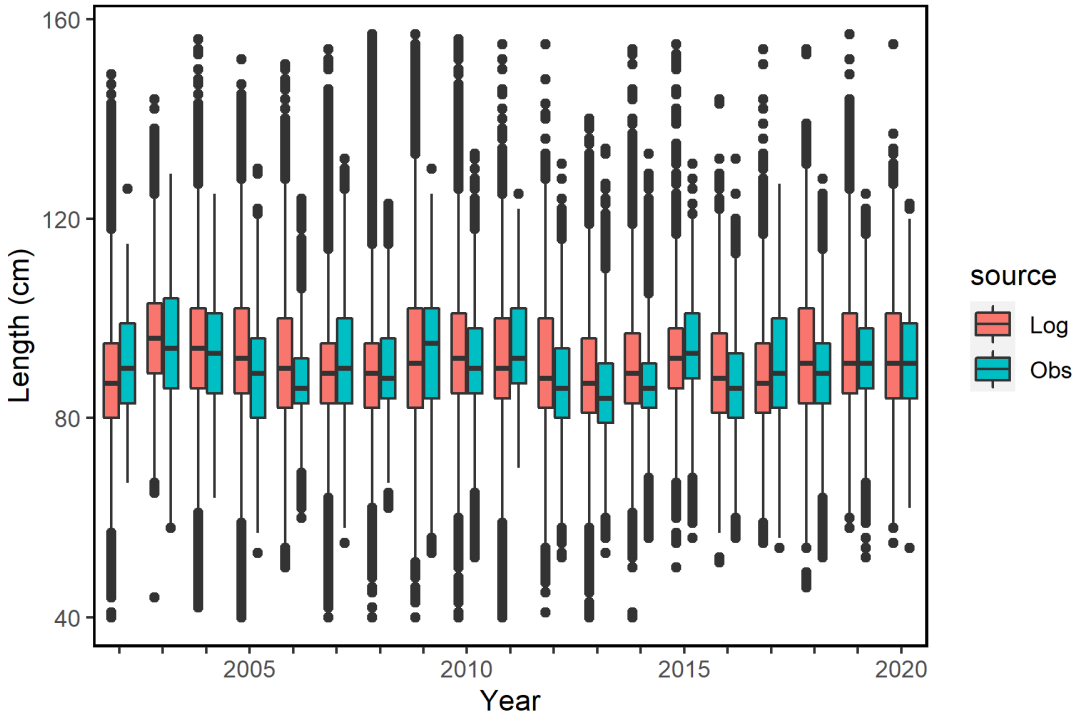

Fig 17. The annual length distributions for albacore reported by Taiwanese large-scale longline fishery and scientific observer program in the Indian Ocean.

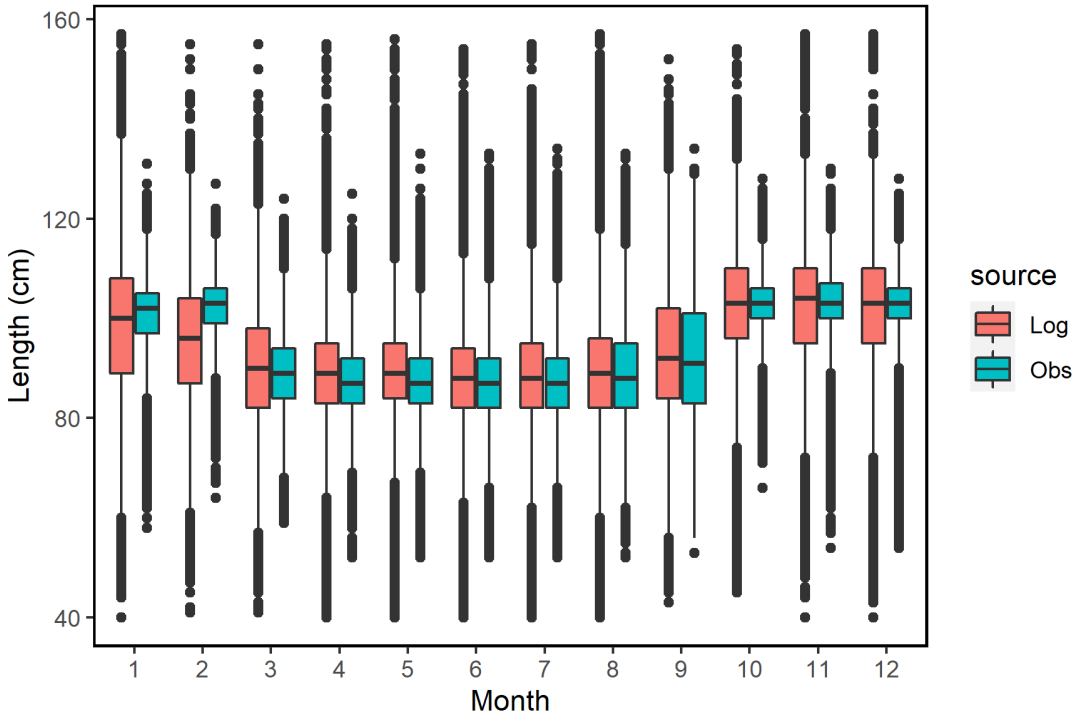

Fig 18. The monthly length distributions for albacore reported by Taiwanese large-scale longline fishery and scientific observer program in the Indian Ocean.

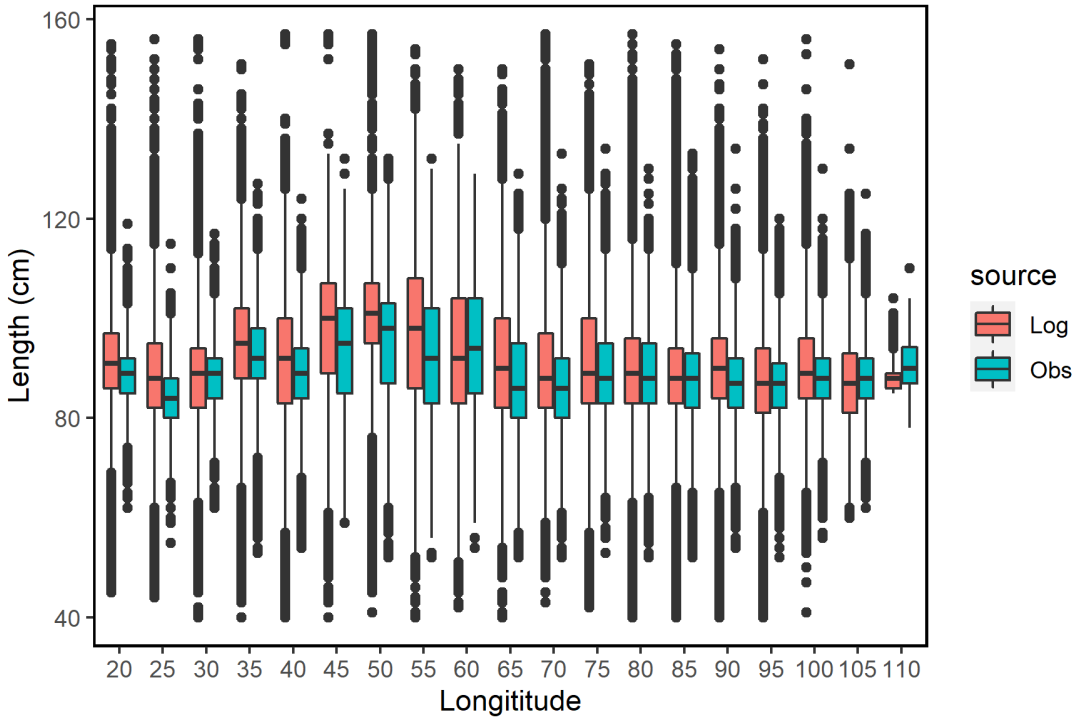

Fig 19. The longitudinal length distributions for albacore reported by Taiwanese large-scale longline fishery and scientific observer program in the Indian Ocean.

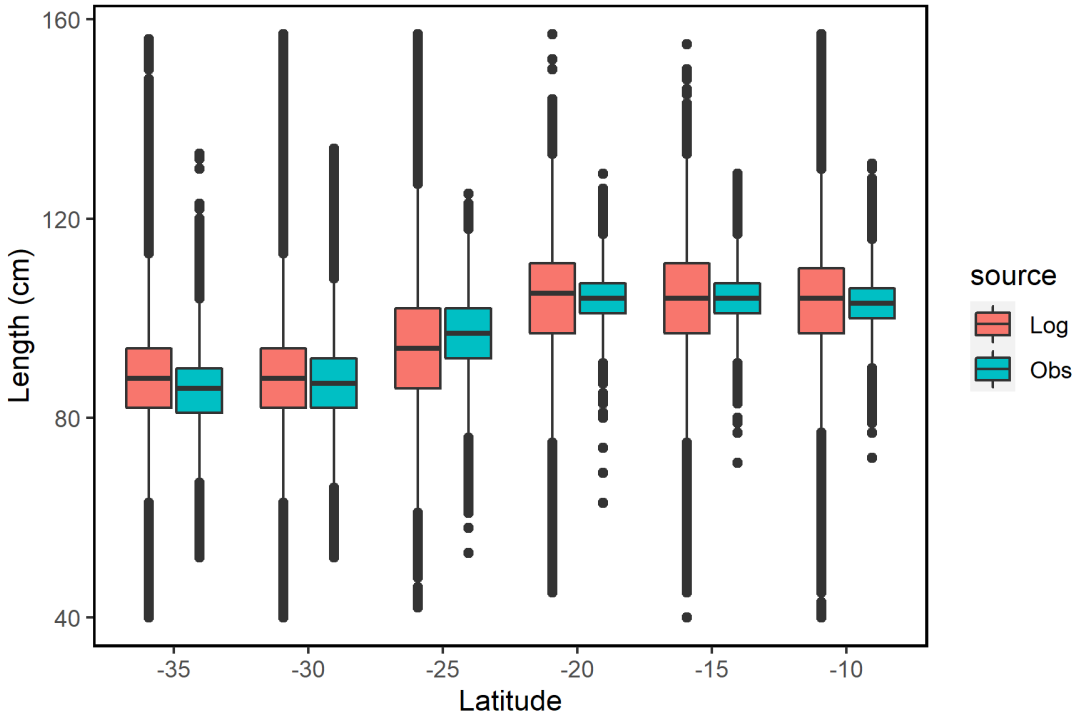

Fig 20. The latitudinal length distributions for albacore reported by Taiwanese large-scale longline fishery and scientific observer program in the Indian Ocean.