Preliminary result of effectiveness of seabird mitigation measures by Japanese observer data in 2018-2020

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Summary

To examine the effectiveness of the mitigation measures, the seabird bycatch rate (BPUE) was standardized with the data in 2018-2020. The effort of observer data used in this study was spread roughly evenly from the Atlantic to the Pacific area. Because BPUE at hooks set at night or/and at a higher proportion of weighted branch line was tended to be lower, it is indicated that the night setting and weighted branch line was effective. Also, even during the daytime, BPUE at the proportion of over 80% of weighted branch line was tended to be lower. Since the statistical significance was not observed from the confidence interval, this result is a preliminary and it is important to collect the data and further examination.

1. Introduction

The provision for the mandatory use of two of the three mitigation measures, tori line, night setting and weighted branch line, in areas of high seabird bycatch risk has been in force since 2013 for ICCAT and IOTC, and since 2014 for WCPFC. As these measures have been in force for a considerable period, it would be desirable to conduct a review of their effectiveness. Considering the relationship between the bycatch level and the implementation of mitigation measures on actual vessels could provide some indication of the effectiveness of the current regulations. In this study, the seabird bycatch rate (BPUE) was standardized among areas with the data after the regulation was installed, then the effectiveness of mitigation measures was discussed.

2. Materials and methods

Japanese observer data of 33 cruises, 1,823 operations south of 30 degrees south from April in 2018 to August in 2020 were used.

The percentage of weighted branch lines among all branch lines was calculated for each

basket, and the time of sunrise and sunset was used to determine whether the basket was set during day or night. Observed hooks and the number of seabirds captured per basket was calculated by estimating the operation time from the line-setting and line-hauling time, assuming that the setting operation and hauling operation are carried out at a constant speed. The area was assigned 70W to 20E as Atlantic, 20E to 70E as Western Indian Ocean, 70E to 150E as Eastern Indian Ocean, and 150E to 180E as the Pacific Ocean. The proportion of the weighted branch line was changed to categorical at 10% unit. The seabird per 1000 hooks (BPUE) was calculated at each night/day, weighted branch line categories, use of tori line, and area.

To examine the effectiveness of mitigation measures, the statistical model below was constructed and AIC was calculated among all the combinations of the explanatory variables. Zero-inflated model was adopted for the analysis, and Poisson distribution was used for the probability distribution.

Total bird bycaught = night or day + proportion of weighted branch line (category) + with toriline or without toriline + area + ε

Standardized bird bycatch per 1000 hooks and confidence interval were calculated with bootstrap sampling by 1000 times. All analysis has been carried out by R language software (ver. 3.6.1) and "pscl" package for zero-inflated model analysis.

3. Results

The effort of observer data used in this study was spread roughly evenly from the Atlantic to the Pacific area (Figure 1). The effort was relatively high around 0 E in the Atlantic and Tasman Sea (Figure 1).

The AIC of the full model with all the mitigation measures and area as explanatory variables was the lowest in the AIC among all the combinations of explanation valuables. By using the best model, BPUE was standardized among areas (Figure 2). BPUE at hooks set at night was tended to be lower than that at hooks set at day. BPUE at a higher proportion of weighted branch line was tended to be lower than that at 0% of the weighted branch line (Figure 2).

4. Discussion

In this study, we attempted to examine the effects of each combination of the three seabird bycatch mitigation measures and found that at least the combination of tori line and weighted branchline and tori line and night setting may effectively reduce seabird bycatch. Interestingly, when tori line and night setting were combined, the additional use of weighted branchline did not contribute to the reduction of bycatch so much. This result may indicate that ensuring the implementation of the current mitigation measures will contribute significantly to the reduction of vulnerable seabird bycatch.

Unfortunately, we were not able to estimate the effect of the combination of weighted branchline and night setting or the sole use of each mitigation measures in this analysis. This can be attributed to the extremely small number of records of operations without the use of tori line. Since the use of tori line is a common practice among Japanese longline vessels, it may be difficult to verify the bycatch mitigation effect of the non-tori line option using data from Japanese vessels.

Because BPUE at hooks set at night or/and at a higher proportion of weighted branch line was tended to be lower, it is indicated that the night setting and weighted branch line was effective. Also, even during the daytime, BPUE at the proportion of over 80% of weighted branch line was tended to be lower.

Because this study was a preliminary analysis, it was not possible to test the statistical significance of each bycatch reduction option. Further analyses by several member countries will need to be reported in the future to verify the effectiveness of seabird bycatch reduction measures.

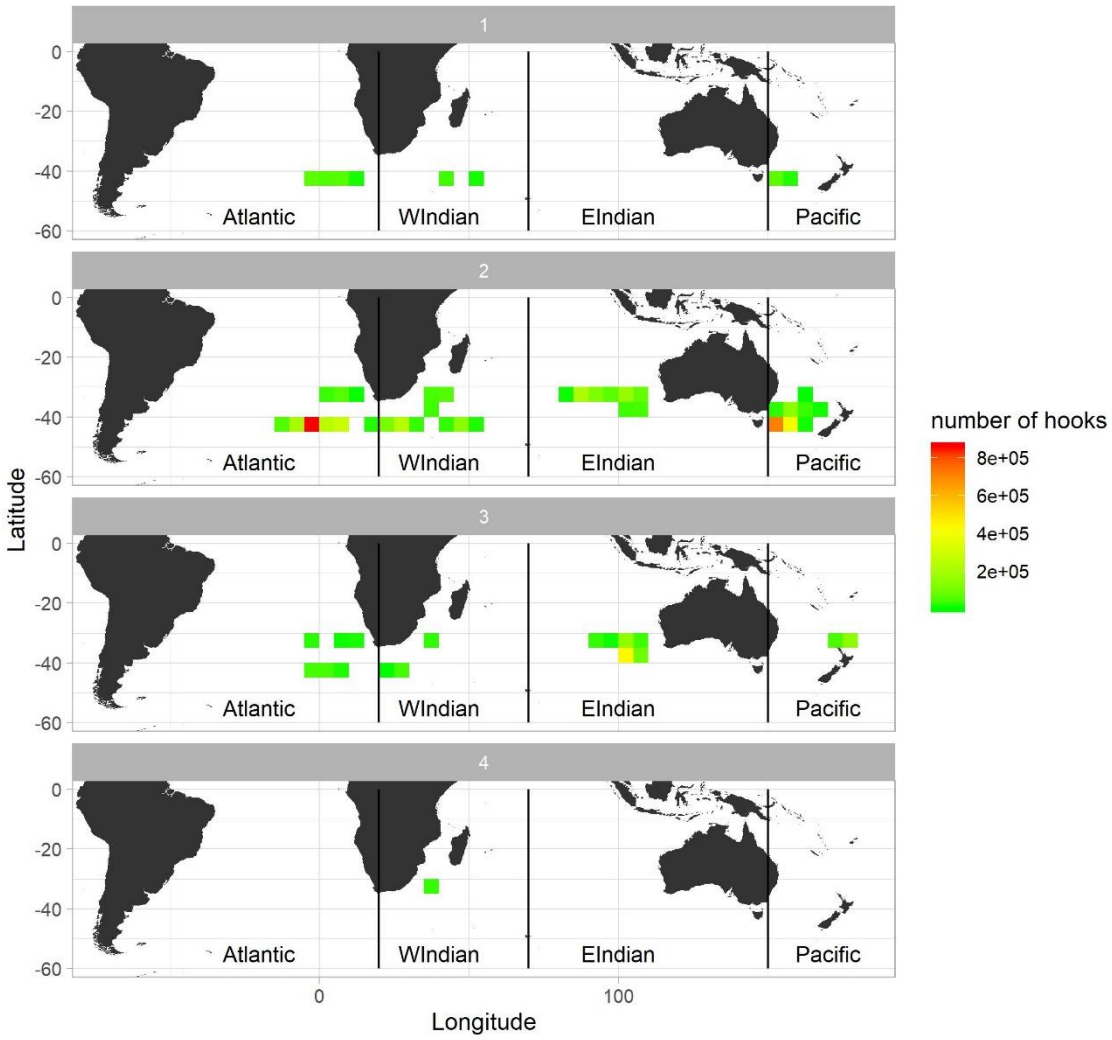

Figure 1 The effort map of observer data of which operation was used for this study at each quarter.

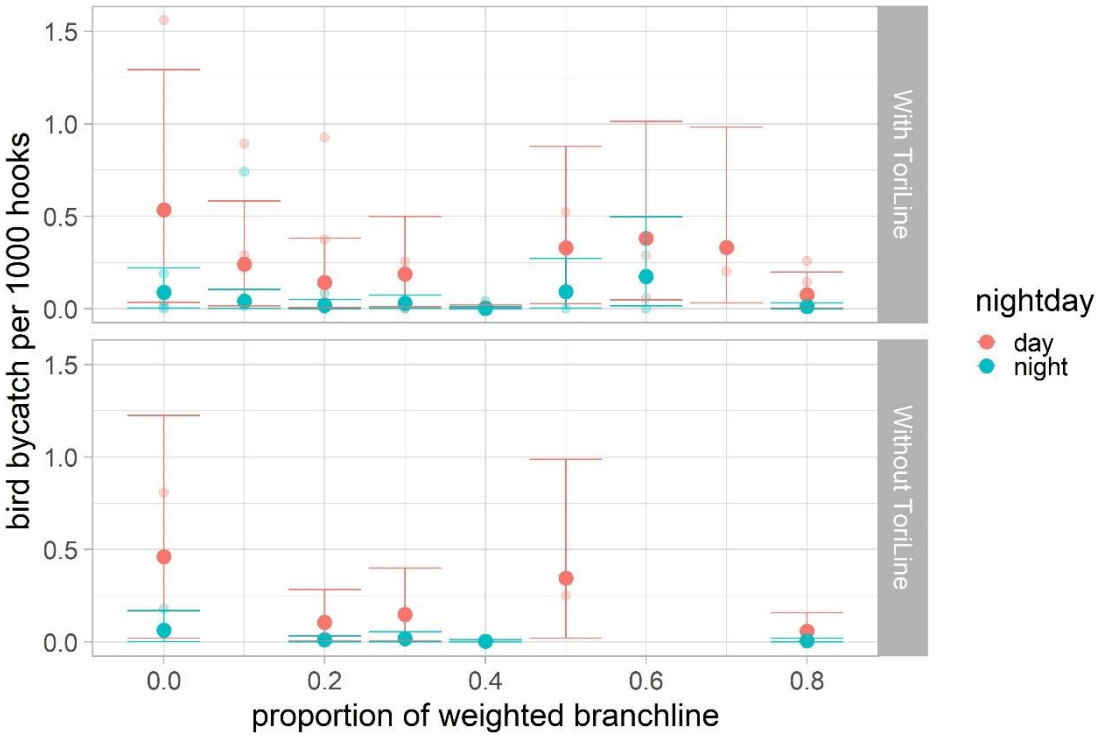

Figure 2 Bird bycatch per 1000 hooks at day time/night time, and the with/without toriline among each proportion of weighted branch line. The strong color circle shows standardized points and the light color circle shows nominal BPUE at each area. The error bar shows the confidence interval.