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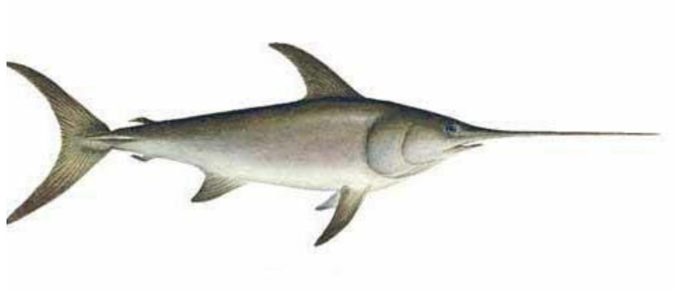
Preliminary results of estimated and observed habitat preferences for Striped Marlin by using Japanese training vessels

Minoru Kanaiwa
Tokyo University of Agriculture
196 Yasaka, Abashiri, Hokkaido, Japan 099-2493

Kotaro Yokawa
National Research Institue of Far Seas Fisheries
5-7-1 Orido, Shimizu, Shizuoka, Japan 424-8633

Keith Bigelow
NOAA Fisheries
Pacific Islands Fisheries Science Center
2570 Dole St., Honolulu, HI 96822, USA



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Summary

The longline fishery data of Japanese training vessels is analyzed to clarify the habitat preferences of Striped Marlin. CPUE per each depth is used as observed habitat preference and estimated habitat preference is provided by using the statistical application of the habitat-based standardization (statHBS). The ambient temperature is used as environment covariate and is provided from the Global Ocean Data Assimilation System (GODAS). The statHBS can follow the pattern of habitat preferences and provide which temperature fit for the fishery of Striped Marlin. This type of analysis is useful to know well the meaning of operational pattern however consideration of more various type of environment covariates is required.

Introduction

Data from the longline operations of Japanese training vessels represent one of the most reliable data in the tropical and sub-tropical Pacific Ocean. Different from commercial fishery data, detailed data are available such as the position of hooks between the floats where catches were obtained and information to estimate the depth at which hooks were set. These data base has the information of the number of branch line for each fish caught as well as the information of the set depth of hooks monitored by the time-depth recorder (TDR) attached on the branch line. Because the detailed information about the operation are available in the data of the Japanese training vessel, all these data are rather useful in evaluating the methodology such as CPUE standardization that takes into consideration of swimming depth of the catches. The purpose of this paper is to figure out how the statHBS can estimate the habitat preferences and clarify the condition to estimate it correctly. From this analysis it will be provided to figure out which fishery ground is good or bad for the Striped Marlin's fishery.

Material and Methods

Data set

Japanese training vessels have been reported the detailed information about their longline operation since 2000, such as detailed gear configuration (number of hooks per basket (HPB), length of branch line, length of float line etc.) catch by species, number of branch line for fish caught, and the set depth of hook monitored by TDR. These were compiled by NRIFSF as the training vessel database. In the present study, the data of training vessels operated in the central North Pacific from 2000 to 2006 were used.

The area is separated by 170 east degrees longitude and 20 north degrees latitude, because of their operation patterns (Fig. 1).

The observed habitat preference is calculated by using same method with Kanaiwa et al. (2008b), i.e. the catch of Striped Marlin per each hook is calculated in each 2 degree of ambient temperature. The catenary curve is estimated by using shallowest and deepest hook by recorded in each operation (Kanaiwa et al. 2008b). We assumed this calculated habitat preference is rather close to true habitat preference for Stripe Marlin on their preying, for the areas and seasons covered by data.

The annual operational patterns of Japanese training longliners are roughly same between years and they are designated not by the commercial purpose but by administrative reasons such as the schedule of the school they belong to. Also, avoiding the overlap of operational area and season with Japanese commercial boats is an important factor for them to decide their fishing ground. As a result of them, this fleet had a spatial geographical extent (0−45ºN, 140ºE−140ºW) and there largely occurs around the Hawaii.

Environmental covariates of ambient temperature was obtained from the Global Ocean Data Assimilation System (GODAS, *http://cfs.ncep.noaa.gov/cfs/godas/*) and processed according to Bigelow and Maunder (2007). This is the same as in Kanaiwa *et al.* (2008 a), also. These temperature data is used for the estimation of observed habitat preference, also.

Model

The entire parameter setting and model definition of the statistical application of the habitat-based standardization (statHBS) are the same as Kanaiwa *et. al.* (2008a) which followed Maunder *et al*. (2006) and we used 68º as catenary angle for this analysis because it was adopted by the analysis by statHBS with multiple species in Kanaiwa et al. (2008a). Ambient temperature is used as an environmental covariate to compare between observed and estimated habitat preferences because of simplification.

Results and Discussions

The comparison of observed and estimated habitat preferences without area separation is shown in Fig. 2. In observed habitat preference has two peaks of mode around 18 and 26 Celsius degree, which are supposed to reflect two characteristic operations conducted in different areas and seasons. However, the habitat preference estimated by statHBS cannot catch these two peaks (Fig. 2).

Figure 3 shows the comparison between observed and estimated habitat preferences in each area. In north west, estimated habitat preference follows observed one well. In north east, estimated habitat preference a little bit shift higher temperature from observed one. In south east and south west, estimated habitat preference shift lower from observed one.

These estimated habitat preference can fit the form of observed one but the position of the peak of mode shift higher or lower temperature than the observed. This would be due to the differences of shortening ratio of gear setting in each area because in this analysis we used the estimated gear setting in Kanaiwa et al. (2008a), which is more applicable on the sets in the northern areas. Additionally, Kanaiwa et al. (2008a) suggested the southern gear setting was different from northern one. This should be considered more.

In west area, the peaks of the mode of observed habitat preference was higher and the range of the mode was narrower than the ones in east area. This may reflect the fact that eastern areas have more operations conducted in various types of good (or bad) fishing areas, as well as reflect the environmental condition in the western areas is more variable than the east due to the influences of strong Kuroshio current.

In this study we can provide only a part of habitat preferences for Striped Marlin's fishery. From only this result, we cannot say which type of fishing ground is good or bad. However, even with consideration of only ambient temperature, we can show that there is some different in each area so when we will analyze the condition of fishing ground, area stratification is required.

This type of analysis can provide the information which type of habitat fit for some species' fishery. In this analysis, the ambient temperature is including vertical and horizontal habitat preferences. Analyzing the fishery ground's condition should include more environmental conditions like oceanographic current pattern, depth, relative temperature and gradient of temperature to separate these effects. More study which is collaborating with fishery and oceanographic is required.

References

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Fig. 1 Area stratification using in this analysis

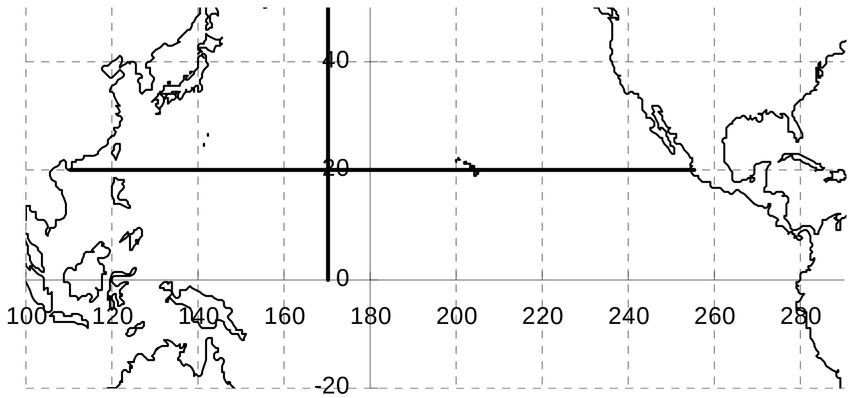

Fig. 2 Observed and estimated habitat preferences without area stratification. Solid line with circle shows the observed habitat preference, light dashed lines show 95% confidence interval of habitat preference estimated by statHBS and dark dashed line shows point estimated habitat preference.

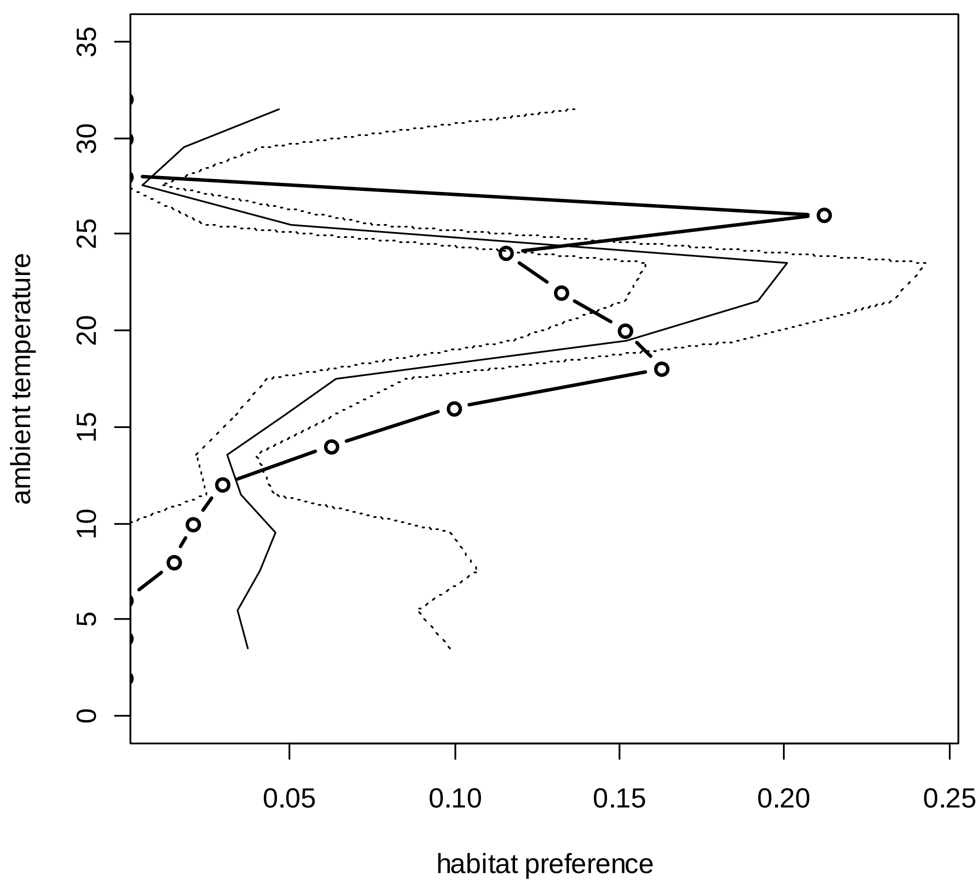

Fig. 3 Observed and estimated habitat preferences in each area stratification. Solid line with circle shows the observed habitat preference, light dashed lines show 95% confidence interval of habitat preference estimated by statHBS and dark dashed line shows point estimated habitat preference.