Updated results of surveys for vertical distribution and spawning condition of adult southern bluefin tuna in the spawning area.

産卵場におけるミナミマグロ親魚の鉛直分布と産卵状態の調査結果

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要約

産卵場において漁獲深度をモニターしながらミナミマグロを漁獲し、鉛直分布、産卵状態と魚体サイズとの関係を調べた。2000 年から 2003 年までの 118 操業で 62 個体を漁獲した。その結果、これまでのインドネシア水揚げ物に基づく結果に対して、大型成魚が主に浅層で漁獲される点では一致していた。しかし、小型成魚は浅層から深層まで全体で深度と無関係に漁獲されており、またほとんど全ての個体が産卵状態にあって深度と産卵状態との関係が認められなかったことは、一致していなかった。

Summary

Vertical distribution and spawning condition relating fish size of adult southern bluefin tuna were investigated in the spawning ground collecting data of depth caught. In total of 118 longline operations between 2000 and 2003, 62 SBT were caught. Against to the previous results based on fish landed at Indonesian ports, one of the results was corresponded that large adults were caught in shallow water. However, our results are discrepant to previous results on the points of that small adults were caught in a wide vertical range without any trend with depth, that almost all of SBT were in spawning condition, and that there is no relationship between maturity stage and depth.

Introduction

Biology of adult southern bluefin tuna (SBT) in the spawning ground has been little understood since Japanese SBT longline fleets cease their operation on the spawning ground in the early 1970s to preserve spawning stock of SBT.　Recently, based on landing of SBT caught by Indonesian longline fleet, which is the main fishing in the spawning ground at present, differences of body size and spawning condition along with depth were reported (Davis and Farley 2001). Japan conducts research surveys every year since 2000 that catch SBT using longline to investigate its vertical distribution and spawning condition. The data contain detail information on operation, depth caught, size of fish, etc., though it is quite smaller in number than that of Indonesian landing data. A part of the results has already reported (Itoh et al. 2002), and this document reports result of data adding two more years.

Method

From 2000 to 2003, total of six research cruises were conducted including four cruises by 2 Taikei-maru (315 tons) and two cruises by R/V Shoyo-maru(2494 tons). The research area was in the southern half of the spawning ground lying between northwest of Australia and Java, Indonesia, and a large part of longline operations were conducted within the Australian EEZ. A set of baskets (basket is a unit between two floats) with 4, 4, 11 branch lines for 2 Taikei-maru and 5, 5, 11 ones for Shoyo-maru were repeated. Time-depth recorders (TDR) were attached in the middle branch lines of a part of baskets to monitor the maximum depth hooks set for each operation.

When SBT was caught, number of branch line per basket and sequential number of the branch line in the basket were recorded, fork length was measured and gonad was sampled. In laboratory, gonads were weighed, histological sections were made and maturity stage and presence of postovulatory follicle were examined. According to Davis and Farley(2001), fish with ovary containing oocytes at migratory nucleus or hydrated stage, which is about to spawn that day, or containing postovulatory follicle, which has spawned less than 24 hours, was classed as in spawning condition.

On the analysis, an order of branch line in a basket was assumed to represent depth of hook settled, thus depth rank 1 are consist of the nearest branch lines to floats and depth rank 6 are consists of 6^{th} branch line of a basket with 11 branch lines. Depth data from TDR will be analyzed near future.

Result

In total of 118 longline operations by six cruises, 62 SBT were caught. Figure 1 shows length frequency distribution of SBT caught. It has the mode at 155 cmFL (fork length) and relatively smaller size fish within the whole size range are dominant. There is little annual difference in length frequency distributions between 2001 and 2003 in which many fish were caught.

Figure 2 shows plots of fork length of SBT caught against depth. Fish less than 165 cmFL were caught in the whole range of depth, but fish larger than 185 cmFL were caught only in shallow water. No particular trend with depth was observed in CPUE except more than 190 cmFL (Fig. 3).

Figure 4 shows Gonad Index (GI : 10^4x (gonad weight in g) / (fork length in cm)^3) and maturity stage against fork length. According to the Kikawa's criteria for maturation (GI>2.0) (Kikawa 1964), all individuals caught had a potential to spawn in this spawning season. All but one individual (95%) are in the spawning condition. No ovaries in 2003 (N=6) has postovulatory follicle.

Figure 5 shows plots of GI and maturity stage against depth. As mentioned above, 95% of individuals were in spawning condition and no relationship was observed.

Discussion

Based on analysis of SBT landed at Indonesian ports, Davis and Farley (2001) reported that there are tendencies that small adults (150-169cmFL） were caught in deeper water and large adults (190-209cmFL) were caught in shallower water. In addition, they also reported that about 70% of female individuals were in spawning condition and the proportion was high in shallow water and low in deeper water. Our present our results adding two more years data correspond with one of their results that large adults were caught in shallow water. However, our results are discrepant to their results on the points that small adults were caught in a wide vertical range without any trend with depth, that almost all of SBT were in spawning condition, and that there is no relationship between maturity stage and depth.

The reason of these discrepancies is unknown, however, there are several potential reasons. The areas of fish caught differ between Indonesian fleet and Japanese research. The ways of longline gear used might be different. The appropriateness of representing depth by BE index, which was used in analysis of Indonesian catch, has not been fully verified (Itoh et al. 2002). Anyway, further investigation is required.

Acknowledgement

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References

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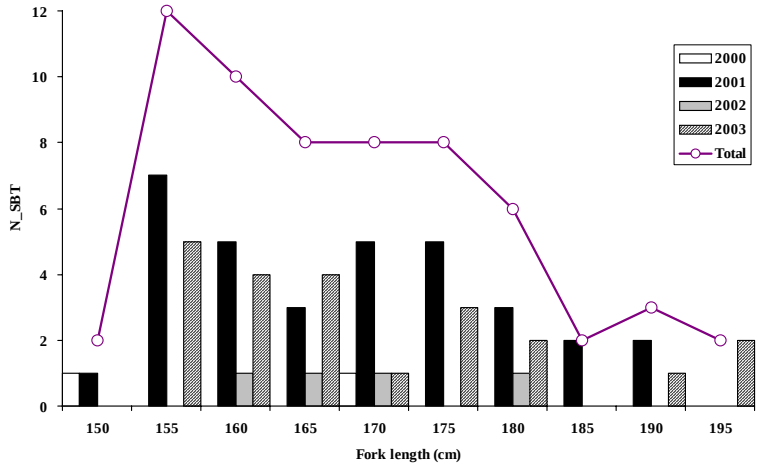

Fig.1 Length frequency distribution of southern bluefin tuna caught in the surveys.

Data by year (bars) and total (line) are shown. Length is in 5 cm class and the label represents the lowest value of the class.

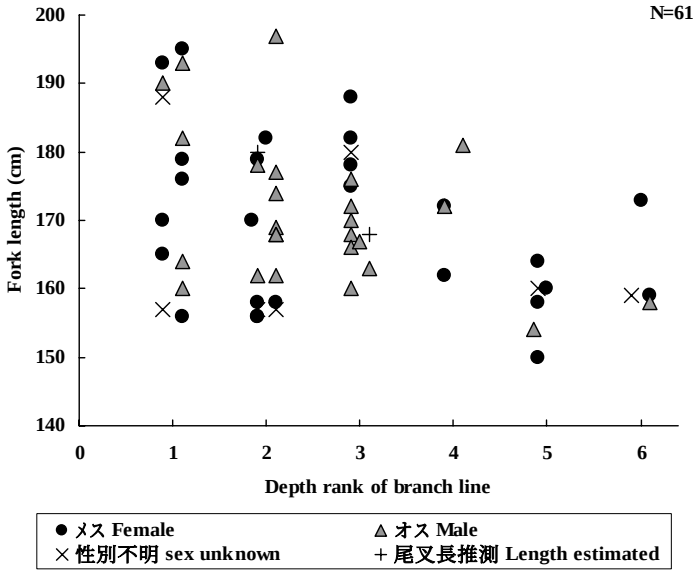

Fig. 2 Plots of fork length of southern bluefin tuna to depth rank of branch line.

Depth rank 1 is the shallowest and 6 is the deepest. X values are slightly shifted by year to easy to see.

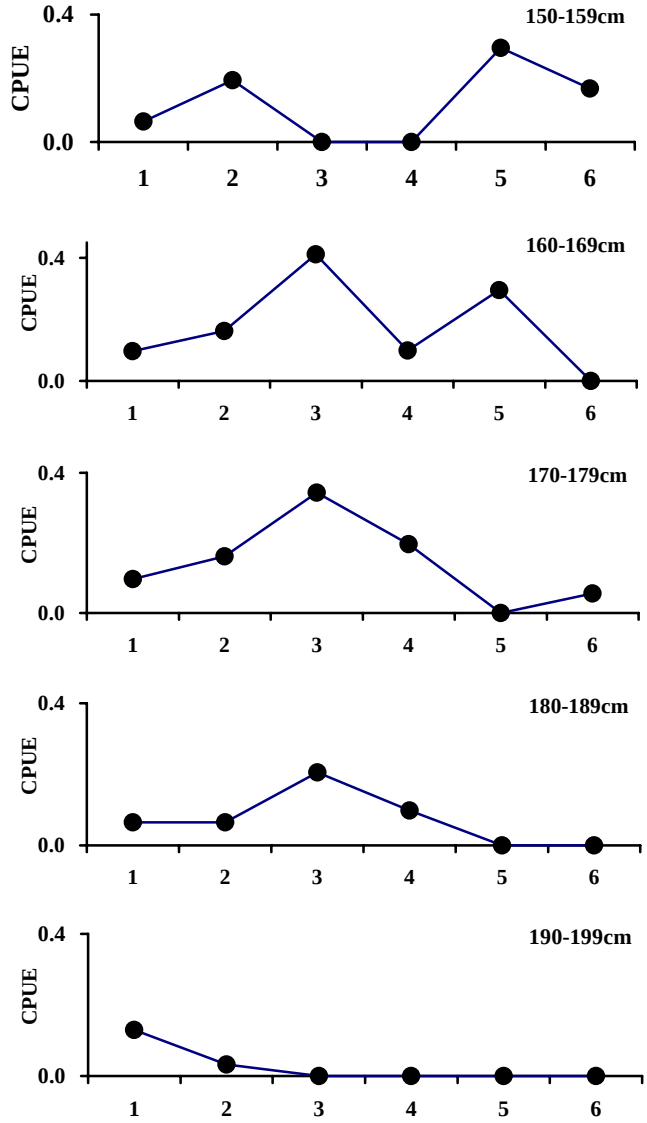

Fig. 3 Nominal CPUE of southern bluefin tuna to depth rank of branch line by 10cmFL class.

Nominal CPUE is catch in number per 1000 hooks. Depth rank 1 is the shallowest and 6 is the deepest.

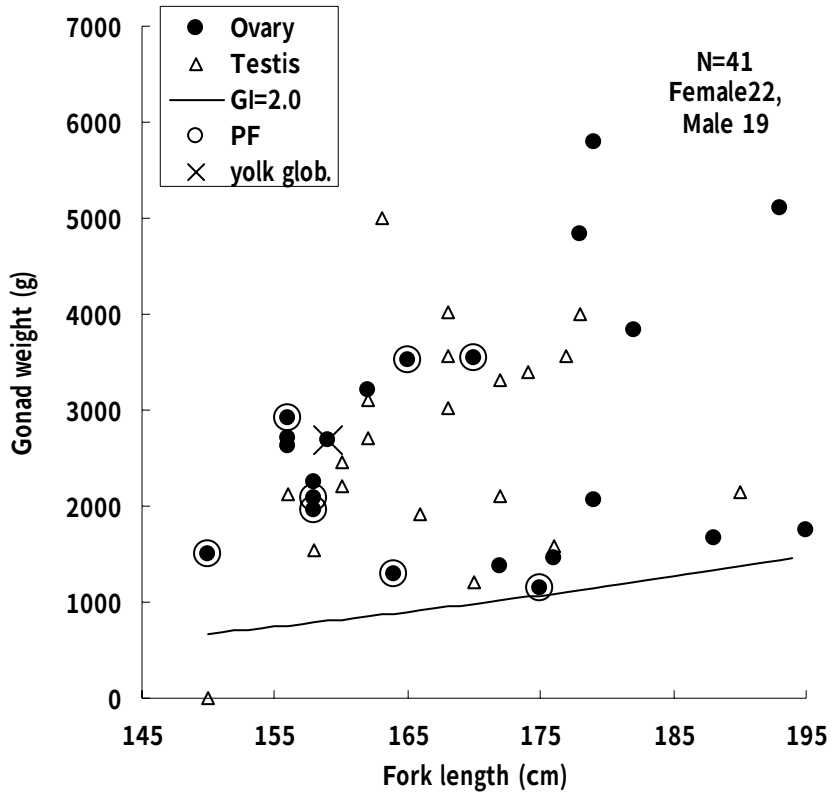

Fig. 4 Plots of gonad weight and its maturity stage to fork length.

PF (○)is postovulatory follicle exist. 'yolk glob.' (×) is in the yolk globule stage, which do not spawn up to 24 hours. Line represent GI=2.0, of which fish with the ovaries spawn in the spawning season.

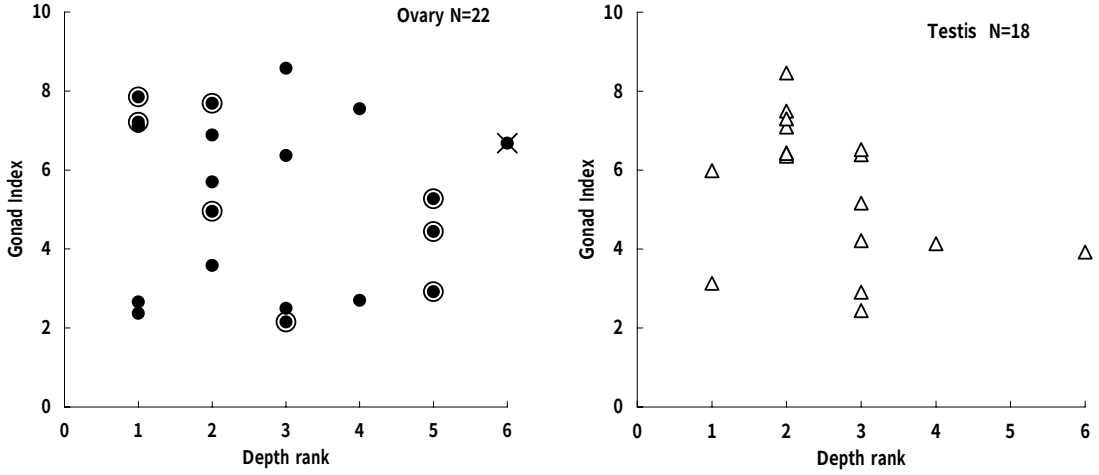

Fig. 5 Plots of gonad weight and its maturity stage to depth rank

Legends are same as in Fig. 4.