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A study of fisheries biology for albacore based on Chinese observer data

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Introduction

China developed its distant-water tuna fishery in the late 1980s. Longlining fishing is the only fishing method applied by Chinese fleets for tuna and tuna-like species in the IOTC water. Bigeye tuna and yellowfin tuna are the main target species, and albacore is only one bycatch for Chinese fleets.

The tuna technical working group of Shanghai Ocean University (SOU) is in charge of the national tuna observer program under authorization by the Bureau of fisheries, Ministry of Agriculture, China. Two or three observers who are graduate students majoring in marine fisheries science & technology of SOU have been dispatched each year in IOTC water since 2003.

In this paper, we studied the fisheries biology of albacore using the data collected by one observer who was dispatched on board deep frozen longliner in the IOTC water in 2009.

Materials and Methods

Study Area and data collection

This observation program was conducted during March 10 and April 12 in 2009. The fishing vessel “Longxing No.602” from Dalian Distant-water Tuna Fisheries Company was boarded by the observer. During the boarding, the fishing area covered 18°-27°S, 59°-68° E (Figure 1).

The total 147 individuals of albacore with total catch 3,531kg was caught during the observer boarding. All the individuals were sampled to record fork length, round weight, stomach weight and gonad weight, etc. The stomach contents and gonad maturity stage were also observed.

Data analysis

The fork length was grouped by 2cm intervals to describe size frequency distribution of albacore.

The length-weight relationship (LWR) is $W=aL^b$, where W is the round weight in gram, L is the fork length in centimeter, a and b are parameters to be estimated by least squares regression.

Stomach fullness of albacore was estimated on a scale of 1 to 5 (1 = empty; 2 < half-full; 3 = half-full; 4 > half-full; 5 = full) (Young and Davis, 1990).

Gonad maturity stage for the albacore was estimated based on West (1990). Gonosomatic index (GSI) was calculated by the equation $GSI = W \times 10^4/L^3$, where W is total gonad weight in gram and L is fork length in centimeter.

Results

Size composition

All albacore individuals caught in the cruise were sampled to measure. There were 22 female and 125 male among these samples. The length frequency distributions of the albacore were shown in Figure 2. The folk length ranged from 96 cm to120 cm, and the dominant folk length ranged from 106 cm-114cm which occupied 76% of total samples. The average fork length was 108.03cm.

Length-weight relationship

Without taking sex into consideration, the length-weight relationship of albacore could be formulated $W = 0.001 \times FL^{2.055}$ (R^2=0.449), by using least squares regression. The LWR could be seen in Figure 3.

Stomach fullness and prey composition

The percentage of stomach fullness scale was presented in Figure 4. Most of samples stomach content was empty or nearly empty whose proportion was nearly 85% of total samples. Prey was found in 21 stomachs could be distinguished. Shrimp, squid, octopus and Alepisaurus ferox were dominant in the diet of the sampled albacores.

Gonad maturity

Most of the albacore samples were near mature, mature or spawned, nearly 90% of total samples whose gonad maturity stages were at IV, V and VI (Figure 5). The relation between GSI and fork length of sampled albacore was presented in Figure 5. The largest GSI measured for the albacore was 5.3 for a 104cm fish. Only 29 albacores had GSIs exceeding 2.0, and 39 sampled albacores' GSIs were less than 1.0. From Figure 5, it showed high GSIs occurred in those albacores with fork length less than 105cm.

Discussion

In this observation cruise, only 22 female albacores and 125 male albacores were caught. Considering the sample amount, we put all samples together in data analysis and omitted sexual difference.

The R square of LWR equation for albacore was only 0.449 and it was too small obviously. It might be owing to that most of the sampled albacores were relatively larger and no small fish caught in the cruise.

Due to limiting of research condition in the fishing vessel, the prey composition of albacore was only distinguished by visual observing. The digested or destroyed prey could not be identified.

The sex ratio of the samples showed that proportion of female was too small. Based on the total 22 female samples gonad maturity analysis, there were 5 and 16 samples whose gonad maturity stages were at V and VI, respectively. That meant the female in the study area was during the production period in the cruise. It might be that the female albacores had higher mortality during this period, and caused the male albacores took great majority.

Acknowledgement

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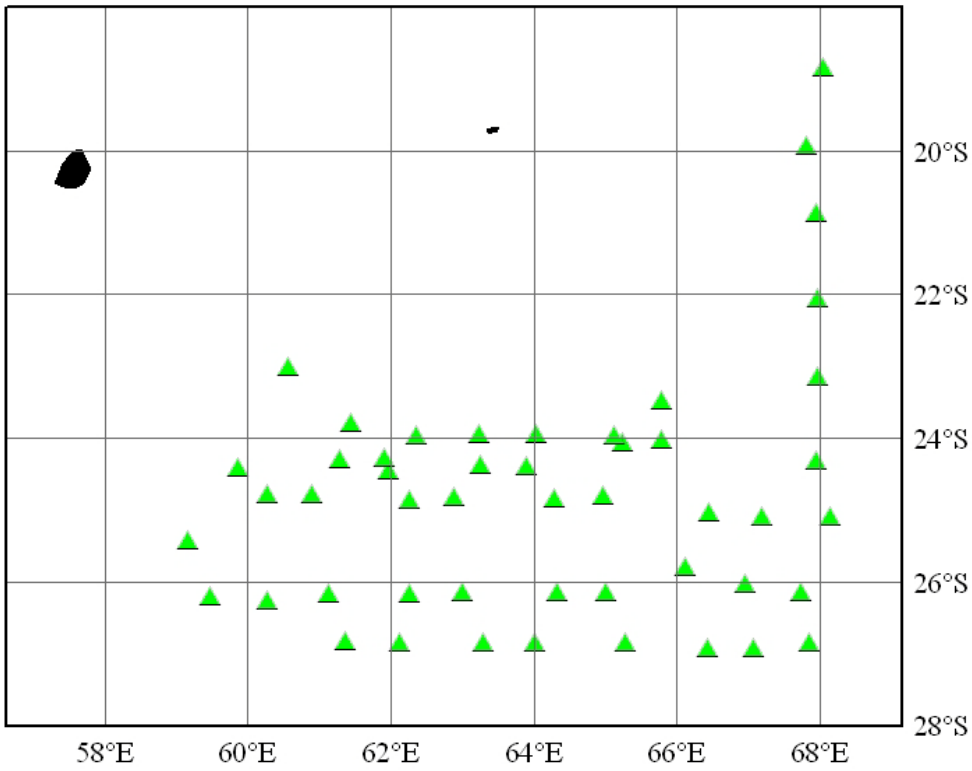

Figure. 1 The distribution of the fishing location

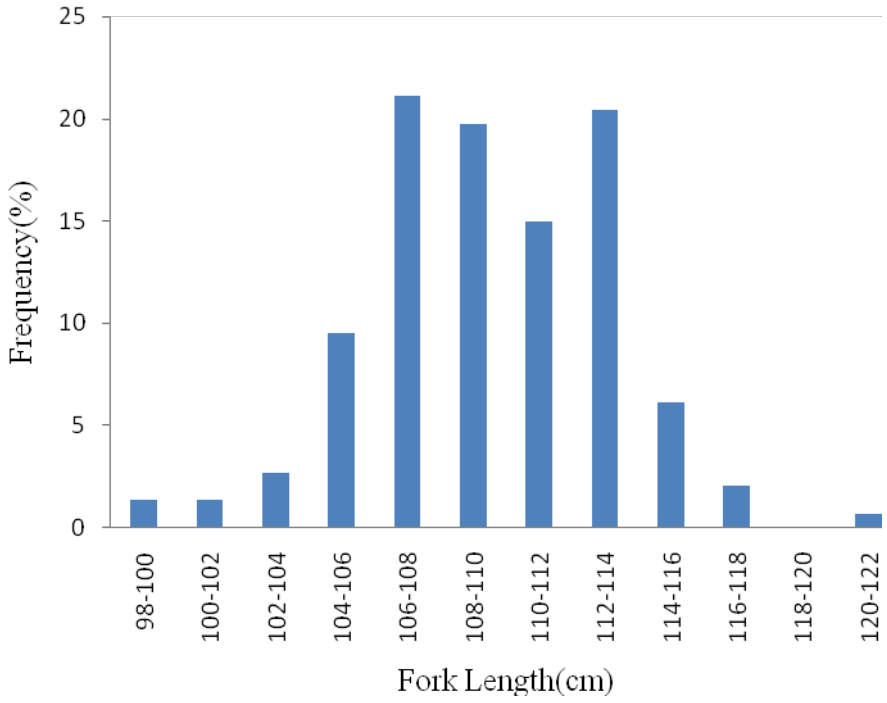

Figure. 2 The length frequency distributions of albacore

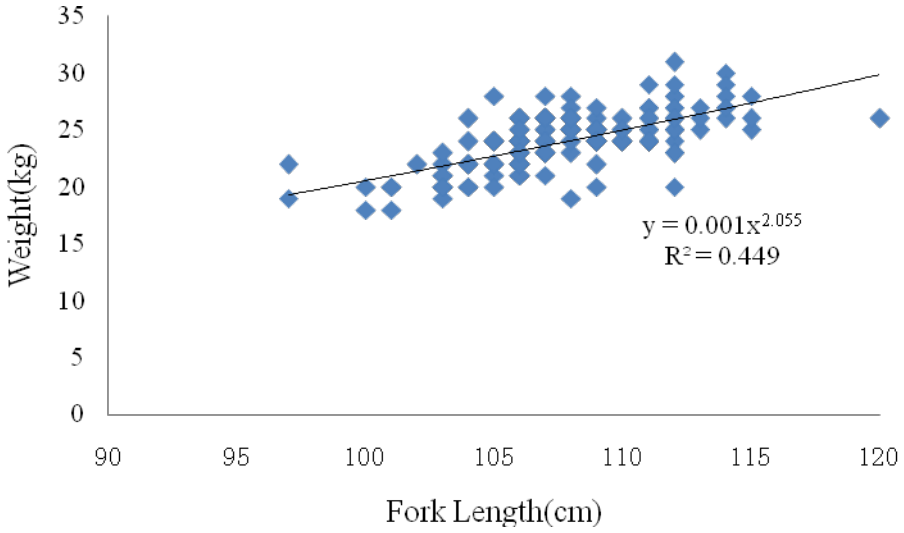

Figure. 3 The relationship between fork length and round weight of albacore

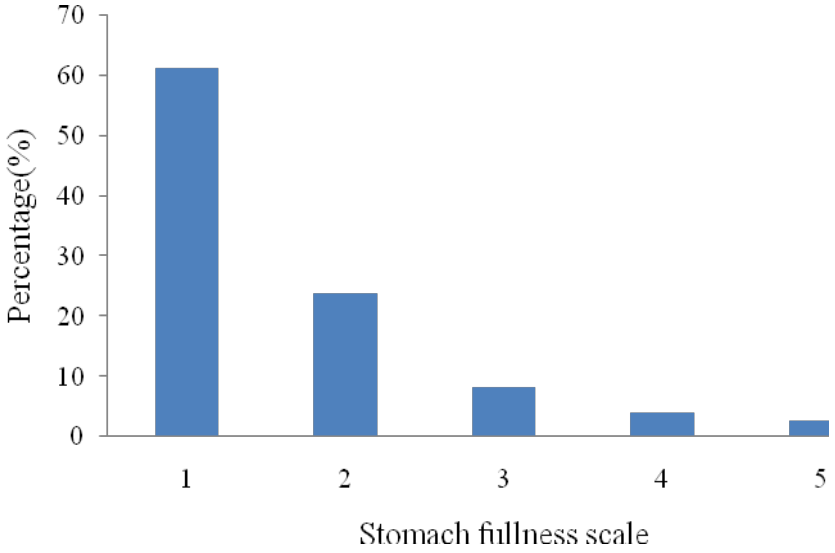

Figure. 4 The percentages of different stomach fullness scales

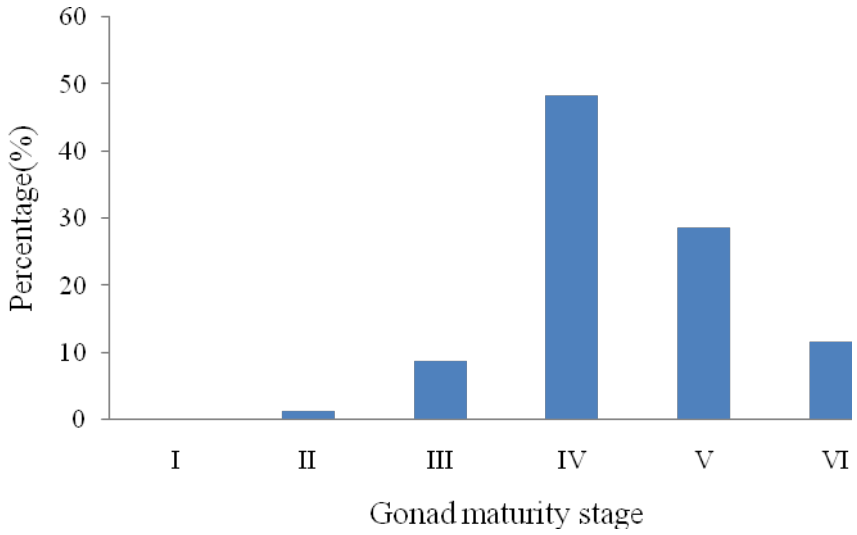

Figure.5 The percentages of different gonad maturity stages

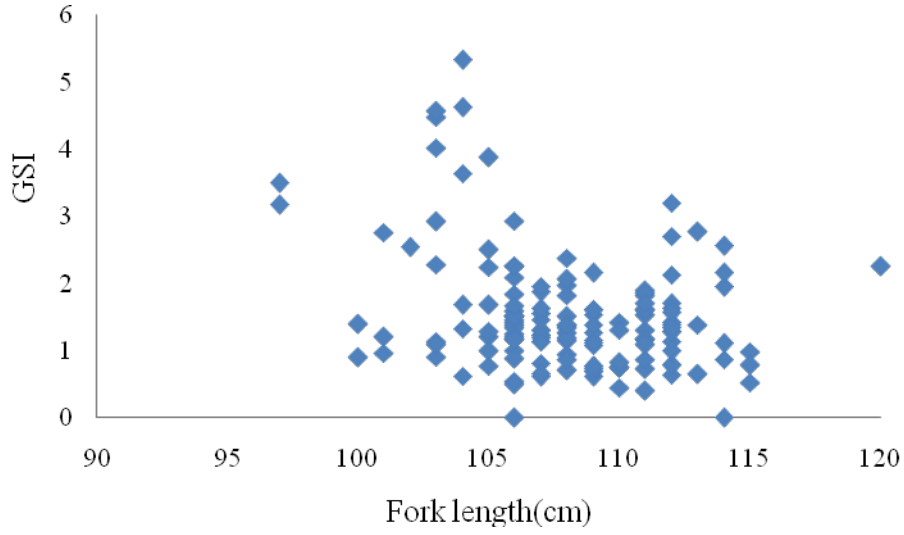

Figure.6 Gonosomatic indices of albacore versus fork length