A preliminary study on the stomach content of southern bluefin tuna *Thunnus maccoyii* caught by Taiwanese longliner in the central Indian Ocean

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Abstract

The stomach contents of 105 southern bluefin tuna (SBT) captured by Taiwanese longliners in central Indian Ocean in August 2004 and June-July 2005 were examined. The size of SBT ranged from 84-187 cm FL (10-115 kg GG). The length and weight frequency distributions indicated that most specimens were in the range of 100-130 cm FL with a body weight between 10 and 30 kg for both sexes. The sexes- combined relationship between dressed weight and fork length can be described by $W = 5.26 \times 10^{-6} \times FL^{3.23}$ (n=105, r^2=0.99, $p < 0.05$). The subjective index of fullness of specimens was estimated as: 1 = empty (34.82%), 2 = <half full (41.07%), 3 = half full (7.14%), 4 = >half full (10.71%), and 5 = full (6.25%). For the stomachs with prey items, almost all the preys are pisces and the proportion of each prey groups are fishes (93.06%), cephalopods (2.21%), and crustaceans (7.02%). In total, 6 prey taxa were identified – 4 species of fish, 1 unidentified pisces, 1 unidentified crustacean, and 1 unidentified cephalopod. The 4 fish species fall in the family of Carangidae, Clupeidae, Emmelichthyidae, and Hemiramphidae.

Introduction

Taiwanese longline fleets catch southern bluefin tuna seasonally in the central Indian Ocean during the period from June to September and the fishing ground is not overlapped with any other southern bluefin tuna fishing country. These tunas ranges from ages 2-18 and dominated by ages 3-5 (Shiau et al. 2005). Hence, the biological information of southern bluefin tuna caught by Taiwanese longline fleets is very valuable for understanding the biology of juvenile southern bluefin tuna.

Biological information of southern bluefin tuna is limited despite some descriptions on its age and growth by tagging experiment (Clear *et al*., 2000, Hearn and Ploacheck, 2003), by length frequency analysis (Leigh and Hearn, 2000), vertical and horizontal distribution by sonar detection (Davis and Stanley, 2002), spawning

dynamics (Farley and Davis, 1998), size distribution in the spawning ground (Davis and Farley, 2002). Young *et al*. (1997) reported the feeding ecology of southern bluefin tuna in coastal and offshore waters of eastern Tasmania.

The objective of this study is to analyze the stomach contents of the southern bluefin tuna caught by Taiwanese longliners in the central Indian Ocean. The results of this study will provide useful ecological information especially on predator-prey relation for juvenile and subadult southern bluefin tunas.

Materials and Methods

Stomachs of southern bluefin tuna were collected by 4 observers during the period August 4-23 in 2004 and June 25-July 26 in 2005 caught by Taiwanese longliners in the central Indian Ocean (74.07E-86.32E, 29.25S-32.06S)(Fig. 1). Fork length (FL) and dressed weight (W, GG) were measured to the nearest cm and kg, respectively. Time, location of capture, number of hooks per basket, and bait were recorded. The stomachs were later frozen and transported back to the laboratory for processing.

The relationship between dressed weight and fork length can be described by $W = a \times FL^b$, where a and b are constants.

In the laboratory, the stomachs were opened and assigned a subjective index of fullness (1 = empty, 2 = <half full, 3 = half full, 4 = >half full, 5 = full) following Young *et al*. (1997). The contents were then removed and weighed to 0.01 g. Prey items were identified to the lowest possible taxon, counted, and weighed (0.01 g). Items identified as longline bait were discarded.

Prey taxa were grouped into fish, cephalopods, and crustaceans. The proportions of these groups in the diet were determined by frequency of occurrence, corrected to 100%. The proportion of an individual taxon within each major group was then determined by weight. Daily ration (R) can be expressed as following:

R = SCW/W, where SCW = weight of stomach contents (g), W = dressed weight (kg).

Results and Discussion

The length and weight frequency distributions indicated that most specimens were in the range of 100-130 cm FL with a body weight between 10 and 30 kg for both sexes (Figs. 2, 3). The relationship between dressed weight and fork length can be described by W-FL relation of southern bluefin tuna for both sexes combined (Fig. 4): $W = 5.26 \times 10^{-6} \times FL^{3.23}$ (n=105, r^2=0.99, $p < 0.05$).

The stomach contents of 105 southern bluefin tuna captured in August 2004 and June-July 2005 were examined. The size of tunas ranged from 84-187 cm FL (10-115 kg GG) (Figs. 2, 3). In total, 6 prey taxa were identified – 4 species of fish, 1

unidentified pisces, 1 unidentified crustacean, and 1 unidentified cephalopod. The 4 fish species fall in the family of Carangidae, Clupeidae, Emmelichthyidae, and Hemiramphidae. However, the genus and species have not been identified yet. Young et al. (1997) identified 92 prey taxa including 36 species of fish, 16 of squid, 25 of crustacean and the remainder of molluscs etc. of SBT based on 1219 specimens in the inshore and offshore waters of Tasmania. Marked differences on the results of these two studies might be due to the difference on sampling location and number of diets being examined.

The subjective index of fullness of specimens was estimated as: 1 = empty (34.82%), 2 = <half full (41.07%), 3 = half full (7.14%), 4 = >half full (10.71%), and 5 = full (6.25%). High proportion of empty stomach content was found for specimens less than 90 cm FL and larger than 150 cm FL (Fig. 5). For the stomachs with prey items, almost all the preys are pisces and the proportion of each prey groups are fishes (93.06%), cephalopods (2.21%), and crustaceans (7.02%). The relative proportion of the main prey items was higher for medium size SBT but was low for large and small size SBT (Fig. 6). Usually, the food items in coastal and offshore waters are higher than that in open sea, which might lead to the better feeding condition for SBT in Tasmania then in central Indian Ocean.

The mean ration of southern bluefin tuna was estimated to be 0.32% which is less than 0.8% of wet body weight in offshore waters of Tasmania, and 2.7% of wet body weight in inshore waters (Young *et al*. 1997). The ration was high for medium size SBT but was low for both small and large size SBT (Fig. 7). However, the number of preys per individual decreased with the size of SBT (Fig. 8).

We found the main prey is fish for immature SBT (<155 cm FL) in central Indian Ocean. However, Young et al. (1997) reported that the main preys are fish and juvenile squid in inshore waters and being micronecktons in offshore waters.

This study was based on 2-years data collected by observers and the results were preliminary, more samples are needed to be collected to examine seasonal variation of diets and the difference of diets between day and night. The predator-prey relation for southern bluefin tuna will become clear only if the information above is available.

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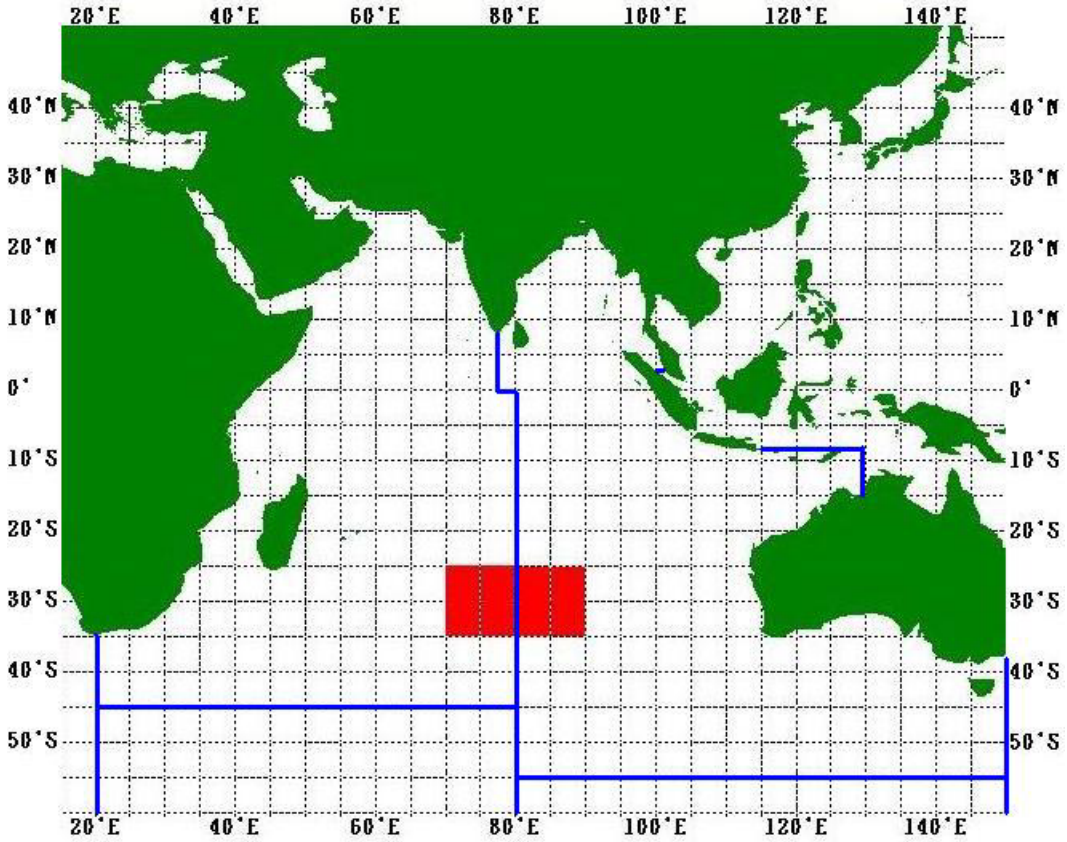

Figure 1. Fishing area of southern bluefin tuna in Indian ocean.

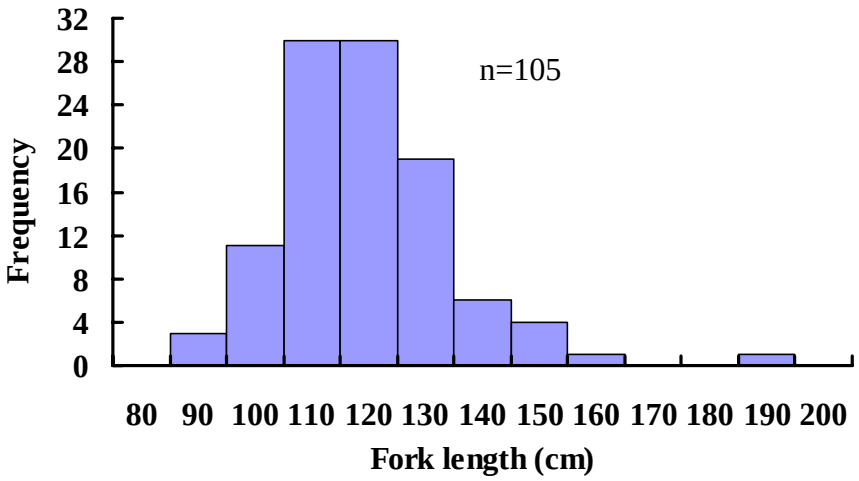

Figure 2. Length-frequency distributions of southern bluefin tuna.

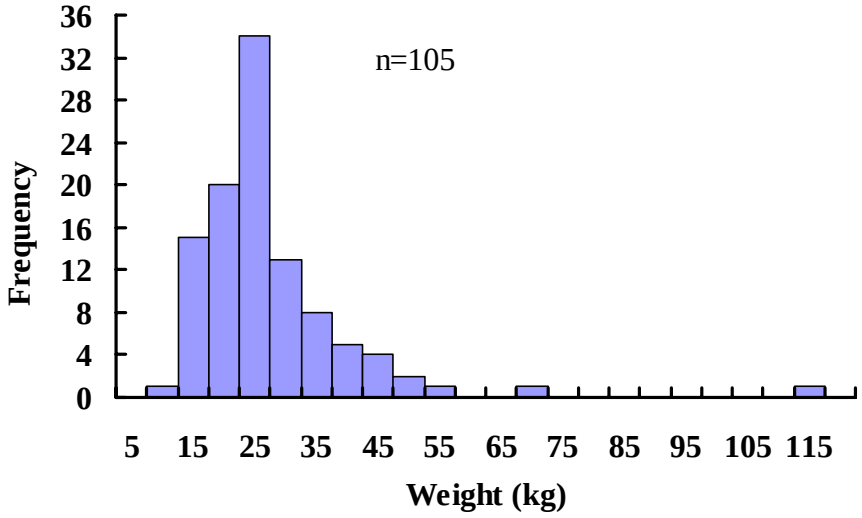

Figure 3. Weight-frequency distributions of southern bluefin tuna.

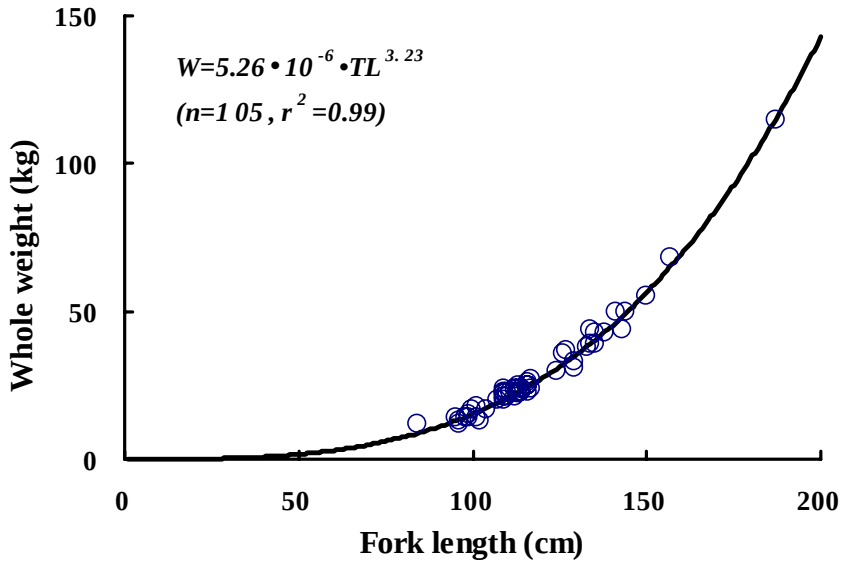

Figure 4. Relationship between whole weight and total length of southern bluefin tuna.

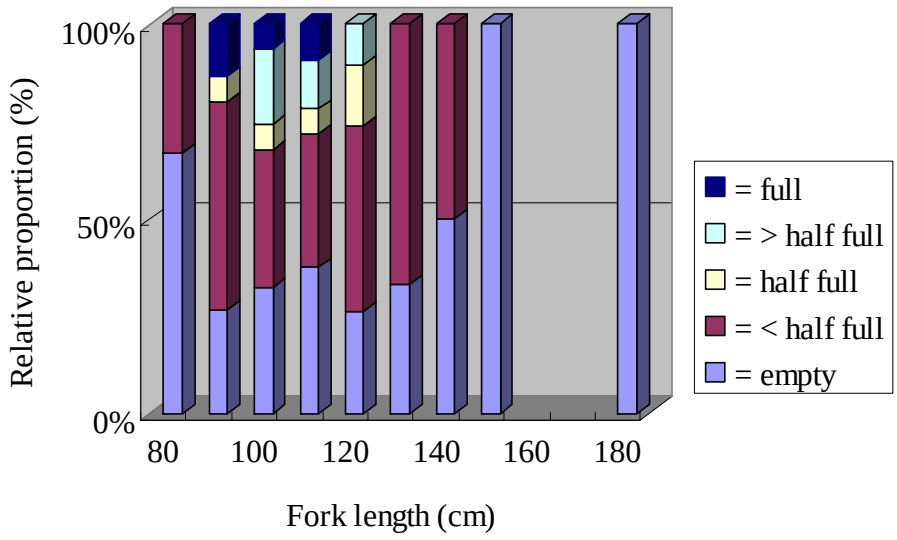

Figure 5. Relative proportions of stomach subjective index of fullness of southern bluefin tuna.

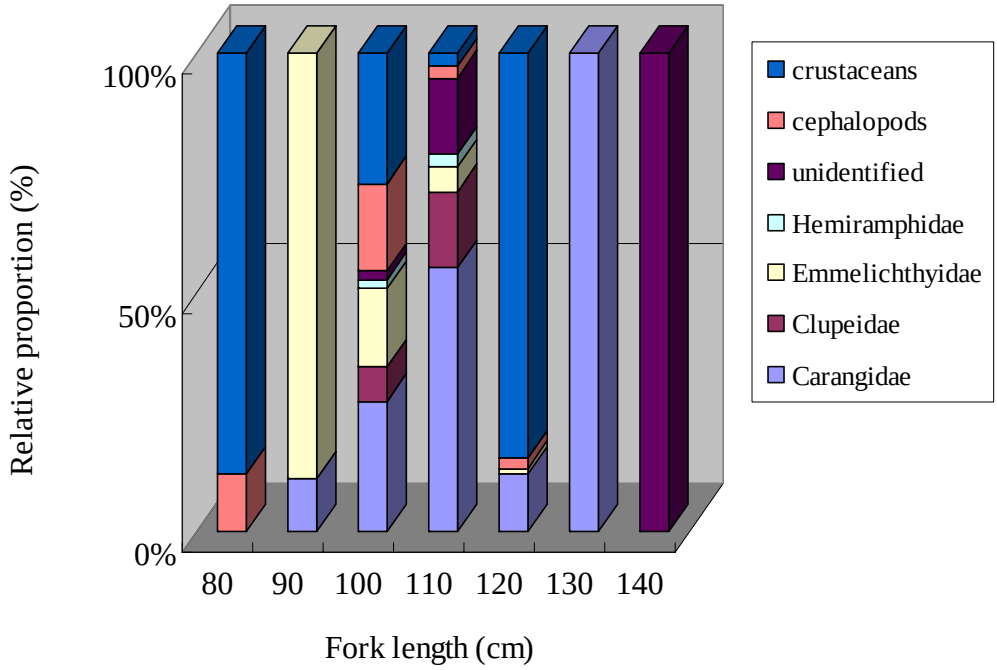

Figure 6. Relative proportions of the main prey of southern bluefin tuna.

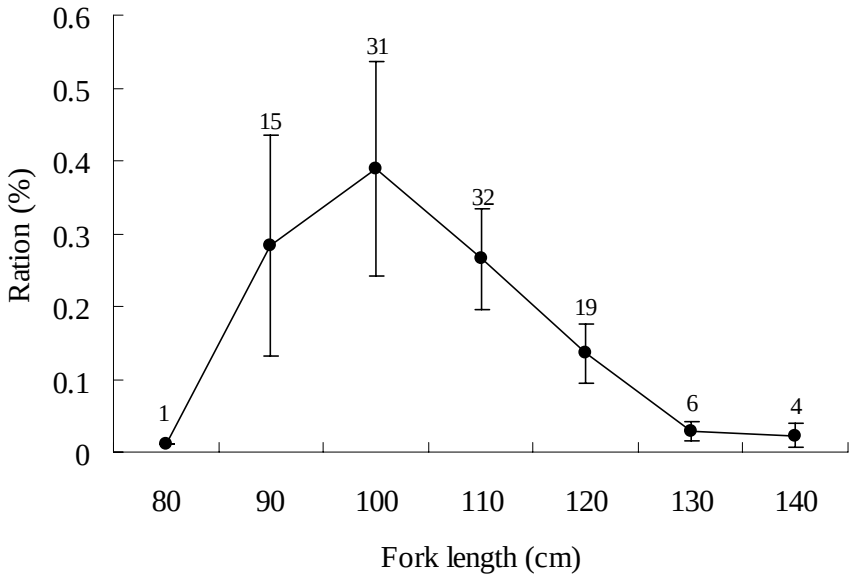

Figure 7. Relationship between daily ration and size of southern bluefin tuna. (Vertical bar indicate ± 1 SE and number was sample size)

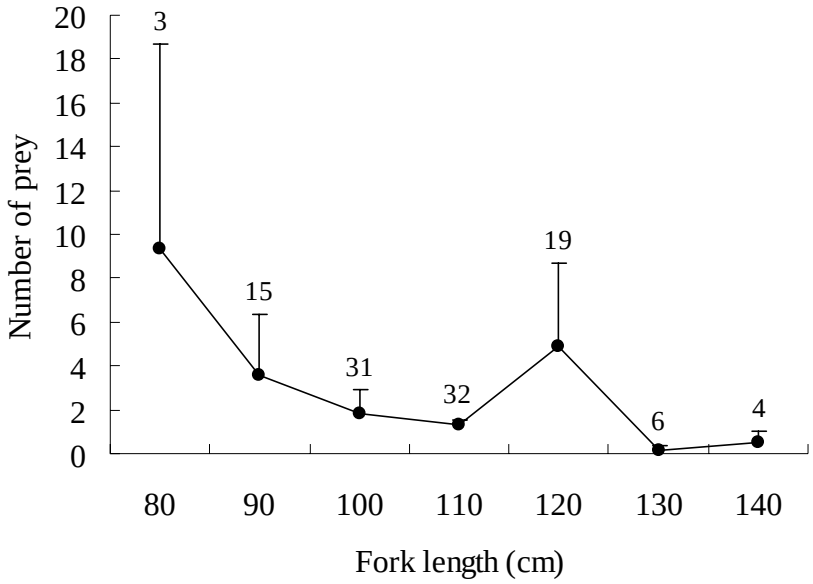

Figure 8. Relationship between numbers of prey and size of southern bluefin tuna. (Vertical bar indicate + 1 SE and number was sample size)