

The Occurrence of Young Skipjack Tuna (*Katsuwonus pelamis*) in the Diet of Adult Skipjack from the Southwestern Atlantic Ocean

LISA ANKENBRANDT¹

Southwest Fisheries Center, National Marine Fisheries Service, NOAA, La Jolla, California, 92038, U.S.A.

Stomach contents of skipjack tuna captured in 1981–1982 by pole-and-line gear off the southern coast of Brazil were analyzed for the presence of larval and juvenile skipjack. The percent frequency of occurrence, percent number and percent volume were evaluated. Of the 1041 stomachs that were examined for food, 436 were empty. The mean volume of food in all stomachs analyzed was 36.9 ml, of which 18.9 ml was bait and 18.0 ml was prey. Larval and juvenile skipjack were not present in the diet of adults from this study.

Les contenus stomacaux de listaos capturés en 1981–82 à la canne au large des côtes sud du Brésil ont été analysés à la recherche de stades larvaires et juvéniles de l'espèce. Le degré de fréquence et les pourcentages numérique et de volume ont été calculés. Sur les 1041 estomacs dont le contenu alimentaire a été étudié, 436 étaient vides. La quantité moyenne de nourriture pour tous les estomacs étudiés était 36,9 ml, dont 18,9 d'appât et 18,0 d'espèces-proies. Aucun listao des stades juvéniles ou larvaires n'a été observé dans l'alimentation des adultes lors de cette étude.

Se analizó el contenido estomacal de listados capturados con caña en 1981–1982 frente a la costa Sur de Brasil, con el fin de constatar la presencia de larvas y juveniles de listado. Se evaluó el porcentaje de presencia, porcentaje del número y porcentaje del volumen. De los 1041 estómagos examinados, 436 estaban vacíos. El volumen medio del alimento encontrado en todos los estómagos analizados era de 36,9 ml, de los cuales 18,9 ml eran de cebo y 18,0 ml presas. No se encontraron larvas ni juveniles de listado en los estómagos de los adultos analizados.

1. Introduction

A Brazilian skipjack pole-and-line fishery has been developing in the Rio de Janeiro area since 1979 (Figure 1). Skipjack is one major tuna species harvested at under maximum sustainable yield in the tropical and subtropical oceans (Kearney 1978; Evans et al. 1981), and therefore, estimation of the fishery potential requires information on the distribution and concentration of its spawning stock. One technique used to determine the existence of a spawning stock is to quantify the distribution of its larvae. Obviously, the presence of large numbers of larvae would indicate a spawning stock occupies an area.

Knowledge of the distribution and abundance of juvenile skipjack is limited. Occasionally, specimens

have been found in experimental plankton hauls or in the stomachs of apex predators (Kearney 1978). From ichthyoplankton surveys Matsuura (1982a) and Nishikawa et al. (1978) report larvae in warm tropical waters north of the study area (Figure 1).

Juvenile skipjack have been found in the stomachs of adult skipjack captured off west Africa and in the Caribbean (Dragovich 1970a; Dragovich and Potthoff 1972; Suarez-Caabro and Duarte-Bello 1961; Klawe 1961). Their occurrence in the diet of central and south Pacific skipjack caught by pole-and-line has been used to deduce their distribution and abundance (Waldron and King 1963; Nakamura 1965; and Argue et al. 1983).

The primary objective of this study was to quantify the occurrence of larval and juvenile skipjack in the stomach contents of adults from the Brazilian fishery. This information could then be used to derive conclusions on their distribution and abundance in this area.

2. Materials and Methods

Stomach samples for this study were collected on a monthly basis from October 1981 to December 1982 from skipjack caught off Rio de Janeiro (Figure 1). U.S. National Marine Fisheries Service (NMFS) personnel collected stomachs from frozen fish transhipped to Puerto Rico, and Superintendencia de Desenvolvimento da Pesca (SUPEDE) personnel sampled fish landed locally in Rio de Janeiro. Fish

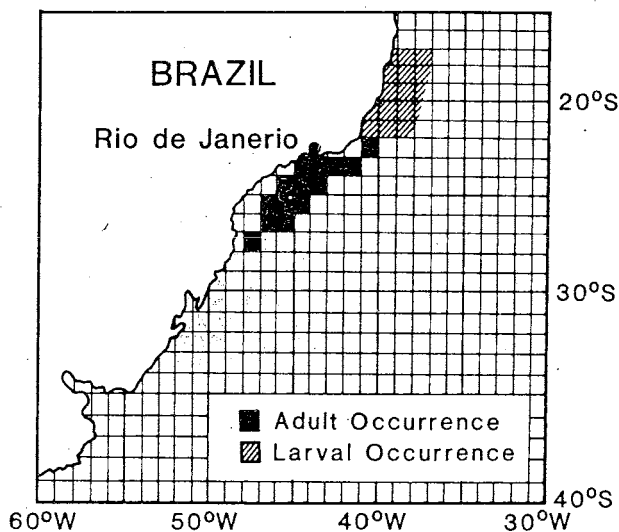


Figure 1. Shaded area indicates occurrence of larval and adult skipjack tuna (Matsuura 1982a).

¹ Present address: School of Fisheries WH-10, University of Washington, Seattle, Washington 98195, U.S.A.

from the Puerto Rican source were sampled within one month of being caught; fish from the Brazilian source were sampled three to five days after the recorded catch date. The sampling design required collecting approximately fifteen stomachs from each 10 cm length group, measured to the nearest cm per month. However, the number of stomachs collected was dependent on the catch size distribution. Once the stomach was removed from the fish, it was preserved in 10% buffered formalin and shipped to the Southwest Fisheries Center (SWFC) for analysis.

Stomachs were examined from 1041 fish between 44 and 81 cm fork length. In the laboratory each stomach was opened. The volume of the food bolus was measured, and the contents were identified to the lowest possible taxon. The taxonomic groupings were then measured by volumetric displacement, and the individuals counted. Whole undigested fish were identified by comparing external characters with those described in published keys or with identified museum specimens from Scripps Institution of Oceanography, La Jolla, California. Digested animals, particularly juvenile scombrids, were identified by vertebral, gill raker, and fin ray counts, as well as other skeletal characteristics, described by Potthoff and Richards (1970), Miller and Jorgenson (1973), and other published keys. The bait consisted of the Brazilian sardine (*Sardinella brasiliensis*), the scaled sardine (*Harengula jaguana*), and the Argentine anchovy (*Engraulis anchoita*); however, other fish families may have been included in the captured bait.

An index of relative importance was calculated for each prey type in terms of numbers, volumes, and frequencies (Pinkas et al. 1971):

$$IRI = (N + V)F$$

where:

N = numerical percentage

V = volumetric percentage

F = frequency of occurrence percentage

These data were stratified by fish length (seven 5-cm categories) and month.

3. Results and Discussion

Of the 1041 stomachs that were examined, 436 were empty. The mean volume of food in all stomachs examined was 36.9 ml, of which 18.9 ml was bait and 18.0 ml was prey. No larval or juvenile skipjack were found in the stomach contents. The results of the other prey data are to be published at a later date.

The multiplicity of prey found in this as well as other studies indicates that tunas are perhaps non-selective feeders, and stomach contents are probably determined by prey availability (Alverson 1963; Hotta and Ogawa 1955; Batts 1972b; Perrin et al. 1973; Argue et al. 1983). Therefore, if the larval and juvenile skipjack were available in significant numbers, then one would expect them to occur in the diet of the adults.

Goldberg and Au (this volume) found no evidence of spawning in skipjack collected from the Brazilian fishery. These results are consistent with the absence of larval and juvenile skipjack in the diet of the adults in this study.

The southernmost distribution boundary for larval skipjack is the 24°C surface isotherm (Argue et al. 1983). Matsuura (1982a) found no larval skipjack in ichthyoplankton surveys south of 21°S latitude in this area, where temperatures range from 21°C to 24°C (Evans et al. 1981).

These results are consonant with those of Argue et al. (1983); juvenile skipjack were absent from samples of adult stomachs taken in subtropical south Pacific waters. The adult skipjack in this investigation did not feed on their young. The absence of cannibalism suggests that larvae and juveniles were not sufficiently abundant to serve as forage of the adults, and therefore, probably do not occur in this cooler southern water (see also Matsuura this volume).