

A NOTE ON THE JUVENILE BLACKFIN TUNA, THUNNUS ATLANTICUS, AND FRIGATE TUNA, AUXIS SPP.,
FROM THE STOMACH CONTENTS OF LONGLINE-CAUGHT TUNAS AND BILLFISHES IN THE WESTERN NORTH ATLANTIC OCEAN

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SUMMARY

Ten juvenile blackfin tuna, *Thunnus atlanticus*, and 148 frigate tuna, *Auxis* spp., were found in the stomachs of tunas and billfishes. These predator stomachs were collected as part of the ISYP activities through the Japanese longline vessels that fished mostly in the western North Atlantic Ocean from March 1980 to March 1982. The number and sizes of the juvenile blackfin and frigate tuna as well as the areas and months of their occurrence were reported.

RESUME

Dix thons à nageoires noires juvéniles, Thunnus atlanticus, et 148 auxides, Auxis spp., ont été trouvés dans l'estomac de thonidés et de poissons porte-épée. Ces estomacs de prédateurs ont été recueillis, dans le cadre des activités de l'ISYP, par les palangriers japonais qui ont surtout pêché dans la partie nord-ouest de l'océan Atlantique de mars 1980 à mars 1982. Le nombre et la taille des thons à nageoires noires juvéniles et des auxides, ainsi que les zones et mois de leur présence, ont été signalés.

RESUMEN

Se encontraron 10 ejemplares juveniles de atún aleta negra, *Thunnus atlanticus* y 148 de melva, *Auxis* spp., en estómagos de túnidos y marlines. Estos estómagos fueron recolectados en el curso de la actividades del ISYP por palangreros japoneses que faenaron la mayor parte del tiempo en el Atlántico Noroeste durante el periodo Marzo 1980 - Marzo 1982. Se informa acerca del número y talla de estos peces, así como sobre zona y mes de recolección.

The western Atlantic endemic blackfin tuna, Thunnus atlanticus, are known to occur from off southern Brazil northward to Cape Cod and Bermuda through the Caribbean Sea and the Gulf of Mexico (Idyll and de Sylva 1963). In the young stage, they are reported from the Caribbean Sea, the Gulf of Mexico and near the Bahamas up to about 30°N (Klawe and Shimada 1959 and Klawe 1961 from Idyll and de Sylva 1963). Two species of Frigate tuna, Auxis thazard and A. rochei, seem to be present in the Atlantic Ocean as well as in the Pacific Ocean, although some questions have been expressed about the presence of A. thazard (Fitch and Roedel 1963, Collette and Gibbs 1963a and Richards and Randall 1967). Similarly, their known range in the western Atlantic extends from off southern Brazil to Cape Cod along the U.S. coast (Uchida 1981).

In this manuscript, we report the occurrence of blackfin tuna, Thunnus atlanticus, and frigate tuna, Auxis sp., from the results of the stomach contents survey on large predators. This survey was conducted as part of the ISEP activities of the ICCAT that just terminated and the samples were collected from the Atlantic Ocean through Japanese longline fishermen's cooperation.

Materials and method

Stomach contents of 187 tunas and billfishes (23 bluefin, 58 bigeye, 40 yellowfin, 42 white marlin, 13 blue marlin, 10 spearfish and 1 sailfish) were examined. These predators were caught by the longline fishery from March 1980 to March 1982 over the entire width of the North Atlantic with the extreme range from 7°S to 43°N, but particularly in the northwestern part including the Gulf of Mexico. The number of stomach samples from different predator species by month of collection is shown in Table 1.

Stomachs were removed from the fish that came onto the deck and stored in fish holds at about -50° to -60°C for several months to over 1 year until the vessels returned to the Japanese ports. For individual samples, the container number, date, position, predator species, their sex and length or weight and water temperature were recorded. However, available records were often lacking some of these items. Frozen samples were then transported to the Far Seas Fisheries Research Laboratory, where they were defrosted and

the contents were preserved in 10 % formalin. Round freezing with the contents kept inside saved fishermen's trouble but generally resulted in adverse specimens in formalin fixation. For skipjack and related groups, the standard length was measured to the nearest millimeters or, where heavily digested, it was estimated from the head length or on fewer occasions from the length of vertebral centra. Features on the axial skeleton as well as gill raker counts were examined for species identification.

Result

Sampling sites are within the six squares indicated in Fig. 1, which represent the maximum range. The majority of stomach samples (173 out of 187) were collected from Areas 1, 2, 3 and 4. The number of blackfin tuna and frigate tuna (Auxis sp.) obtained and the number of stomach samples examined for these six areas are shown in Table 2.

Blackfin tuna

Ten blackfin tuna specimens were obtained; 9 from Area 3 and 1 from Area 2. No blackfin tuna occurred in the stomach contents from the Gulf of Mexico (Area 1) and from the eastern (Area 5) and southeastern (Area 6) Atlantic. Individual records at time of occurrence are available as in Table 3. These specimens ranged in length from 110mm to 280mm SL and occurred in July and August in Area 3 and in September in Area 2. Only white marlin and yellowfin tuna stomachs had blackfin tuna.

No blackfin tuna were obtained from other predator species. We examined, for example, 38 bigeye tuna stomach contents from Areas 2 and 3 (3 in June, 21 in July and 14 from September to January) and 15 giant bluefin tuna stomach contents (all in March) from the eastern Gulf of Mexico. It seems that these predators rarely feed on, or are less accessible to, blackfin tuna due probably to the gap between their spatio-temporal existence. For off-shore Area 4 from which no blackfin tuna came, 12 yellowfin tuna stomach contents were

sampled mostly in June (11 in June and 1 in October) but not in July and August. Blackfin tuna from the stomach contents of the western North Atlantic tunas are also known from Matthews et al. (1977), who list a large variety of food organisms eaten by tunas and lancetfishes. They do not give detailed records of individual specimens at time of occurrence but their blackfin tuna are from the longlin^a-caught tunas. Their study area, extending from the U.S. coast far into the Gulf Stream flowing eastward, well covers Areas 2, 3 and 4 of the present survey. Blackfin tuna have sometimes been hooked on the longline gear in the western North Atlantic fishing grounds. The available length measurement data suggest that they are the feeding adults (Hisada unpublished).

Frigate tuna, Auxis sp.:

A total of 148 Auxis specimens were obtained; 138 from Area 3, 6 from Area 2 and 4 from Area 4 (Table 2). They ranged in length from 78mm to 296mm SL and occurred from June to November. The length distribution of 124 Auxis specimens is shown by month of occurrence in Table 4.

Auxis occurred from many predator species. White marlin stomachs from Area 3 had 76 Auxis in all and coming next to it were both yellowfin tuna (31) and spearfish (31). In the number of Auxis eaten per predator, however, spearfish from this area came first (3.3) and ranking next to it was white marlin (1.9) and then yellowfin tuna (1.6). This may account for much fewer occurrence of Auxis from shoreward Area 2, from which only small number of these predator stomachs were collected (0 spearfish, 1 white marlin and 8 yellowfin). An Auxis of 296mm SL, the largest taken, occurred from a 235cm EFL blue marlin stomach from Area 4 and one from a bluefin tuna stomach from the same area. Bigeye tuna stomachs as well as giant bluefin tuna stomachs from the eastern Gulf of Mexico never had Auxis. This is quite similar to the case of T. atlanticus and seems to suggest the predators' less accessibility to Auxis. Matthews et al. (1977) list Auxis among food organisms eaten by the western North Atlantic tunas.

Table 5 shows the gill raker counts of 45 Auxis specimens from this survey. These specimens are grouped into two at 150mm SL for comparison. The central raker is here included in those on the upper limb. The difference in the counts between the smaller and larger groups is not evident. The total number of gill rakers of 45 specimens ranges from 37 to 44. This is close to the counts on the western Pacific and central Pacific Auxis thazard but evidently fewer than those on the eastern Pacific Auxis thazard by Fitch and Roedel

(1963). The two largest specimens, 296mm and 295mm SL, have the gill raker counts of 6+1+30 and 8+1+32, respectively. These two specimens seem to be A. thazard rather than A. rochei in the general body plan as well as the gill raker counts.

Literature cited

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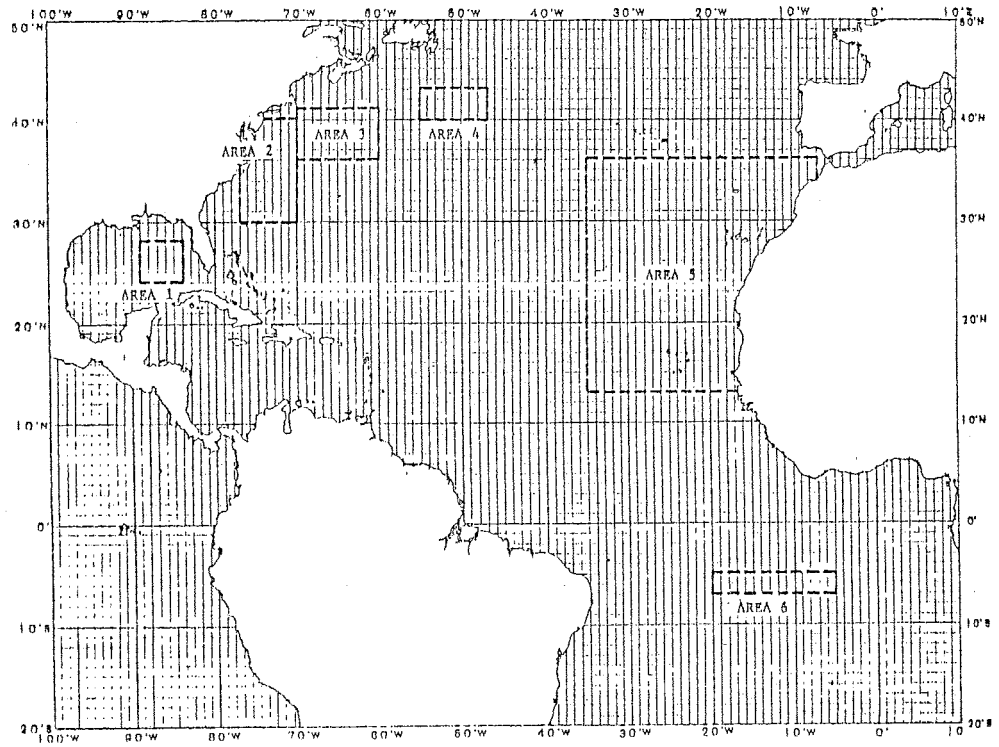


Fig. 1 Sampling areas of stomach contents

Table 1 Number of predator stomachs by sampling month

| Predator species | Sampling month | | | | | | | | | | | | Total | Length | |
|------------------|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|---------|-----------|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | Range | \bar{x} |
| Bluefin tuna | | | 15 | | 2 | 3 | 1 | | | | 2 | | 23 | | |
| Bigeye tuna | 2 | 1 | | | | 7 | 21 | | 5 | 8 | 9 | 5 | 58 | 100-168 | 134 |
| Yellowfin tuna | | 1 | | | | 15 | 4 | 11 | 6 | 1 | 1 | 1 | 40 | 72-170 | 133 |
| White marlin | | | | | | 14 | 27 | 1 | | | | | 42 | 107-160 | 137 |
| Blue marlin | | 2 | 6 | | | 1 | 2 | | 1 | 1 | | | 13 | 180-235 | 207 |
| Spearfish | | | | | 1 | 3 | 4 | 1 | 1 | | | | 10 | 120-160 | 132 |
| Sailfish | | | | | | | 1 | | | | | | 1 | | 130 |
| Total | 2 | 4 | 21 | | 3 | 43 | 60 | 13 | 13 | 10 | 12 | 6 | 187 | | |

Table 2 Occurrence of *Thunnus atlanticus* and *Auxis* sp. by area and predator species.
N, No. of stomachs examined; t, *T. atlanticus*; a, *Auxis* sp.

| Predator species | Area 1 | | | Area 2 | | | Area 3 | | | Area 4 | | | Area 5 | | | Area 6 | | |
|------------------|--------|---|---|--------|---|---|--------|---|-----|--------|---|---|--------|---|---|--------|---|---|
| | N | t | a | N | t | a | N | t | a | N | t | a | N | t | a | N | t | a |
| Bluefin tuna | 15 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 1 | 2 | 0 | 0 | | | |
| Bigeye tuna | | | | 12 | 0 | 0 | 26 | 0 | 0 | 18 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| Yellowfin tuna | | | | 8 | 1 | 6 | 19 | 3 | 31 | 12 | 0 | 2 | | | | 1 | 0 | 0 |
| White marlin | | | | 1 | 0 | 0 | 4 | 6 | 76 | | | | | | | | | |
| Blue marlin | | | | | | | 4 | 0 | 0 | 1 | 0 | 1 | | | | 8 | 0 | 0 |
| Spearfish | | | | | | | 9 | 0 | 31 | | | | 1 | 0 | 0 | | | |
| Sailfish | | | | | | | 1 | 0 | 0 | | | | | | | | | |
| Total | 15 | 0 | 0 | 22 | 1 | 6 | 101 | 9 | 138 | 35 | 0 | 4 | 4 | 0 | 0 | 10 | 0 | 0 |

Table 3 Occurrence of *Thunnus atlanticus* from stomach contents

| Date | Position | t°C | SL(mm) | Predator | | |
|--------------|-----------------|------|--------|--------------|-----|--------|
| | | | | Sp. | Sex | BL(cm) |
| 7 Jul. 1980 | 39°25'N 63°09'W | 26.2 | 146 | White marlin | f | 140 |
| 30 Jul. 1980 | 38°00'N 62°30'W | - | 110 | White marlin | - | - |
| 5 Aug. 1980 | 38°40'N 63°01'W | 28.7 | 180 | Yellowfin | m | 135 |
| " | " | " | 172 | " | " | " |
| " | " | " | 165 | " | " | " |
| 4 Jul. 1981 | 38°57'N 63°28'W | - | 140 | White marlin | - | 148 |
| 7 Jul. 1981 | 39°37'N 62°56'W | - | 190 | White marlin | - | 150 |
| 8 Jul. 1981 | 39°54'N 63°31'W | - | 204 | White marlin | - | 154 |
| 12 Jul. 1981 | 38°13'N 65°20'W | - | 230 | White marlin | - | 140 |
| 6 Sep. 1981 | 36°41'N 74°21'W | 24.2 | 280 | Yellowfin | - | 105 |

Table 5 Gill raker counts of *Auxis* specimens obtained.

| Size range | Upper | | | | | | Lower | | | | | | |
|----------------|-------|---|---|----|----|----|-------|----|----|----|----|----|----|
| | 6 | 7 | 8 | 9 | 10 | 11 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
| 90 - 150mm SL | 3 | 2 | 4 | 5 | 3 | 4 | 4 | 3 | 7 | 5 | 5 | 1 | 1 |
| 151 - 296mm SL | 1 | 1 | 1 | 6 | 8 | 2 | 1 | 4 | 3 | 6 | 5 | | |
| Total | 4 | 3 | 5 | 11 | 16 | 6 | 5 | 7 | 10 | 11 | 10 | 1 | 1 |

| Size range | Total number of gill rakers | | | | | | | | | | | |
|----------------|-----------------------------|----|----|----|----|----|----|----|----|----|----|----|
| | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
| 90 - 150mm SL | | | | 2 | 1 | 6 | 3 | 7 | 6 | 1 | | |
| 151 - 296mm SL | | | | 1 | 2 | | 4 | 6 | 2 | 3 | 1 | |
| Total | | | | 3 | 3 | 6 | 7 | 13 | 8 | 4 | 1 | |

Table 4 Monthly length distribution of *Auxis* sp.

| SL (mm) | Jun | Jul | Aug | Sep | Oct | Nov | Total |
|-----------|-----|-----|-----|-----|-----|-----|-------|
| 71 - 80 | | | 1 | | | | 1 |
| 81 - 90 | 3 | 4 | | | | | 7 |
| 91 - 100 | | 2 | 1 | | | | 3 |
| 101 - 110 | | 4 | 2 | 1 | | | 7 |
| 111 - 120 | 4 | 10 | 2 | | | | 16 |
| 121 - 130 | 1 | 15 | 3 | | | 1 | 20 |
| 131 - 140 | 3 | 15 | | | | | 18 |
| 141 - 150 | 1 | 8 | 1 | 1 | | | 11 |
| 151 - 160 | 2 | 6 | 2 | 1 | | | 11 |
| 161 - 170 | 4 | 2 | 3 | 2 | | | 11 |
| 171 - 180 | 4 | 1 | | 5 | | | 10 |
| 181 - 190 | | 1 | | | | | 1 |
| 191 - 200 | | | | | | | |
| 201 - 210 | | | | 1 | | | 1 |
| 211 - 220 | | | 2 | 1 | | | 3 |
| 221 - 230 | | | | | | | |
| 231 - 240 | | | | 2 | | | 2 |
| 241 - 250 | | | | | | | |
| 251 - 260 | | | | | | | |
| 261 - 270 | | | | | 1 | | 1 |
| 271 - 280 | | | | | | | |
| 281 - 290 | | | | | | | 1 |
| 291 - 300 | | | | | 1 | | 1 |