First record of a yellowfin tuna (*Thunnus albacares*) from the stomach of a longnose lancetfish (*Alepisaurus ferox*)

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In 1987 we found a juvenile yellowfin tuna, *Thunnus albacares* (Bonnaterre, 1788), in the stomach of a longnose lancetfish, *Alepisaurus ferox* Lowe, 1833. Analysis of published information on lancetfish food habits (Haedrich, 1964, 1969; Haedrich and Nielsen, 1966; Parin, 1968; Parin et al., 1969; Fourmanoir, 1969; Grandperrin and Legand, 1970; Kubota and Uyeno, 1970; Legand et al., 1972; Kubota, 1973; Fujita and Hattori, 1976; Matthews et al., 1977) led us to conclude that this was the first record of a yellowfin tuna found in a lancetfish stomach.

Although this finding has been recorded in "gray literature" (Zamorov et al.[1]; Zamorov and Romanov[2]), the limited circulation of this type of literature, the fact that there were some inaccuracies in the details of the record, and the absence of similar findings in recent studies (Okutani and Tsukada, 1988; Moteki et al., 1993), led us to publish the finding with correct information in the following note.

Materials and methods

A juvenile yellowfin tuna (Fig. 1) in good condition was found in the stomach of a lancetfish caught by pelagic longline on 17 May 1987 during a research cruise in the waters of the exclusive economic zone of Mauritius, western Indian Ocean. The longline set position was 9°32′S, 58°03′E. The depth of hook, which caught the lancetfish, was 99 m.

Results and discussion

The fork length (FL) of the lancetfish was 167 cm, its weight was 9 kg; FL of the yellowfin tuna was 37 cm and its weight was 790 g. The tuna was immature and its stomach was empty. The tuna was 22.2% of the lancetfish body length and 8.8% of its weight. The tuna was found in the lancetfish stomach with its tail towards the mouth of the lancetfish. Evident transverse lateral damage to the tuna body included long, deep, open wounds and an absence of skin and scales in the middle part of the body. Deep wounds were absent on the head and caudal part of the tuna, where damage was minor (Fig. 2). Analysis of the photos allowed us to hypothesize about the manner of capture. Presence of transverse damage to the middle part of the body suggested that the tuna was caught by the lancetfish across the body and held until it lost its ability to swim. The teeth of the lancetfish had also caused cuts, likely inflicted during the convulsive struggle of the tuna to free itself. The absence of wounds in other parts of the tuna's body, in particular on its head, indicated that after the tuna became inactive, it was released from the predator's teeth and swallowed head-first. The proportions of the lancetfish mouth and the victim allowed the tuna to be swallowed whole.

Longnose lancetfish is a common bycatch species on tuna longlines in the study area, the northern stream of the South Equatorial Current, during the survey (April–June 1987) and are caught regularly at depths of 60–120 m. We have found slow-swimming animals in the stomachs of lancetfish (Zamorov et al.[1]; Zamorov and Romanov[2]; Romanov and Zamorov[3]). The diet of lancetfish consists of pelagic crustaceans (Hyperiidae, Portunidae, Amphipoda), cephalopods of the families Onychoteuthidae, some Ommastrephidae (*Ornithoteuthis volatilis*), Cirroteuthidae, Octopodidae, Argonautidae, Cranchiidae, Histioteuthidae, Bathyteuthidae, and mesopelagic fishes (*Sternoptyx diaphana*, *Paralepis elongata*, *Omosudis lowei*, *A. ferox*, *Antigonia rubescens*, *Tylerius spinosissimus*) (Haedrich and Nielsen, 1966; Parin et al., 1969; Fourmanoir, 1969; Kubota and Uyeno, 1970; Rancurel, 1970; Fujita and Hattori, 1976; Matthews et al., 1977; Moteki et al., 1993). These are slow-swimming species.[4]

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[1] Zamorov V. V., A. M. Amelekhina, and A. A. Rybalko. 1992. On the feeding of *Alepisaurus ferox* Lowe, 1833 in the western Indian Ocean. *In* Fauna and ecology of animals. Proc. Zool. Mus. Odessa State Univ. 1, p. 23–37. Odessa National Univ. (ONU), 2, Dvoryanskaya St., 65000 Odessa, Ukraine. [In Russian.]

[2] Zamorov, V. V., and E. V. Romanov. 1993. New data on feeding of lancetfish *Alepisaurus ferox* Lowe, 1833. *In* Resources of tunas and related species in the World Ocean and problems of their rational utilization, p. 115–116. (Abstracts of the reports presented at first interstate conference "Resources of tunas and related species in the World Ocean and problems of their rational utilization," Kerch 1–5 June 1992). YugNIRO, Kerch. [In Russian.]

[3] Romanov, E. V., and V. V. Zamorov. 2002. Feeding habits of longnose lancetfish (*Alepisaurus ferox* Lowe, 1833) in the western Indian Ocean. Manuscript in preparation.

[4] However, small specimens of the fast-swimming ommastrephid squid *Sthenoteuthis oualaniensis* (Lesson, 1830) (mantle length <10 cm) have been found in the stomachs of lancetfish; the schooling life and common behavior of squids, including periods of slow swimming or passive drift, make them vulnerable to this predator.

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Figure 1

Yellowfin tuna (below) removed from the stomach of the lancetfish (above).

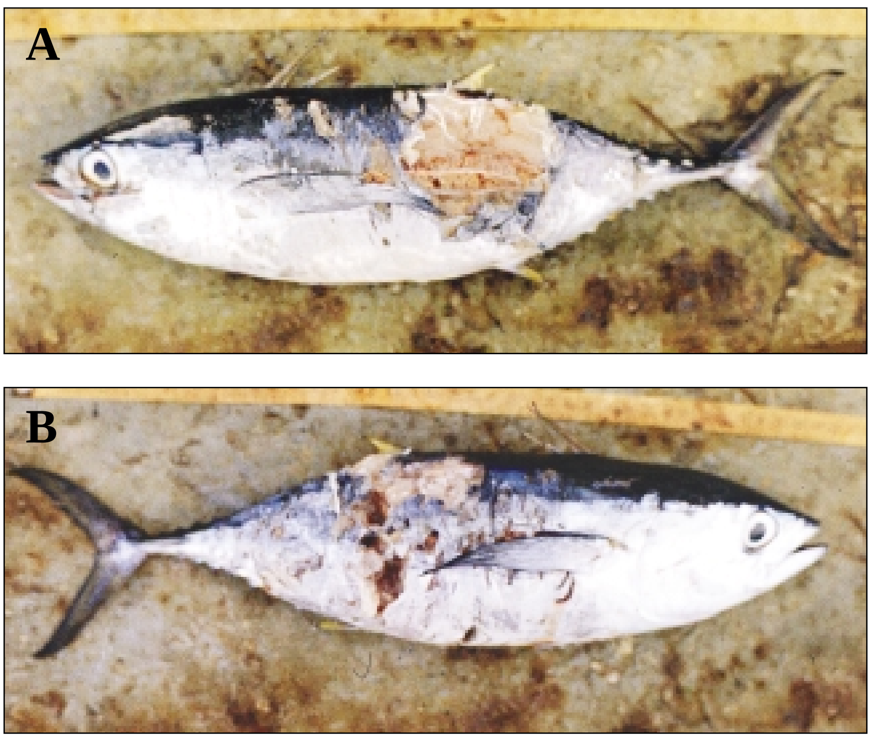

Figure 2

Yellowfin tuna found in lancetfish stomach; viewed from left side (**A**) and right side (**B**).

Studies show that fast-swimming animals, fishes of families Belonidae, Scombridae, Exocoetidae, Carangidae, Coryphaenidae, in particular, and most squids of the family Ommastrephidae, the ordinary food of tunas, are rare or absent in stomachs of lancetfish. Matthews et al. (1977) recorded one case of finding several frigate tunas of the genus *Auxis* in the stomach of one lancetfish, but according to Collette,[5] these were juveniles only 3.9–4.3 cm long. A small (35 cm^3 in volume) juvenile swordfish (*Xiphias gladius*) from a lancetfish stomach was reported by Williams (1967). Large slow-swimming fishes are generally found in the stomachs of lancetfish (Kubota and Uyeno, 1970, Fujita and Hattori, 1976). Cannibalism is also common among lancetfish (Haedrich, 1964; Haedrich and Nielsen, 1966; Fourmanoir, 1969; Matthews et al., 1977; Moteki et al., 1993; Zamorov et al.[1]).

[5] Collette, B. B. 1997. Personal commun. NMFS Systematic Laboratory, National Museum of Natural History, 10th & Constitution Ave. Washington DC, 20560-0153.

Large fast-swimming fish recorded from *A. ferox* stomachs include chub mackerel (*Scomber japonicus*) 35 cm long (Kubota and Uyeno, 1970) and a pink salmon (*Oncorhynchus gorbuscha*) reported by Balanov and Radchenko (1998). However, salmons (*O. gorbuscha, O. nerka,* and *O. keta*) found with slash marks attributed to lancetfish likely indicate that lancetfish also prey on these fast-swimming fish (Radchenko and Semenchenko, 1996).

The jaw structure and large teeth of lancetfish allow these fish to hunt for relatively large animals. However, large epi- and mesopelagic fishes, inhabiting the same or bordering niches with lancetfishes are able to evade attack, as a rule, because of their swimming speeds. The elongate (anguilliform) body of lancetfishes and their flabby and watery muscles suggest an inability to swim for a long time with a high cruising speed in order to chase prey. This species has no developed deep red muscles, a characteristic feature of fishes able to cruise at high speeds (Sharp and Pirages, 1978, He and Wardle, 1988). The muscle tissue of the lancetfish consists mainly of white muscles that are responsible for short-term bursts of motion (Sharp and Pirages, 1978; Schmidt-Nielsen, 1979); and its body form allows it to make short impetuous rushing movements, characteristic of many predatory fishes with anguilliform bodies (Trichiuridae, some of the Gempylidae, Muraenidae, *Anotopterus pharao*, etc.). The high dorsal fin of *A. ferox* and the large area of the caudal fin are additional signs of the high maneuverability of this species for swimming and hunting at short distances.

Yellowfin tuna, unlike lancetfish, are constantly active and swim in a rather fast motion, as has been demonstrated by numerous day-long (or several days long) telemetric tracking experiments (Carey and Olson, 1982; Cayre and Chabanne, 1986; Holland, et al., 1990; Cayre, 1991; Marsac and Cayre, 1998). To maintain hydrostatic equilibrium, small yellowfin tuna swim within the range of 1.3–1.5 body lengths per second (Brill[6]), which in the case of the tuna found in the lancetfish stomach corresponds to a rate of 48–55 cm/s. Rarely the does the speed decrease to 14–22 cm/s (Cayre and Chabanne, 1986, Holland et al., 1990, Brill et al., 1996, Marsac[7]).

Needless to say, it is not easy for a rather slow-swimming lancetfish to catch a fast-swimming tuna. In our opinion, the only way for the lancetfish to catch the tuna was to rush suddenly and to catch the prey with its large saber-like teeth. Ambush-rushing type of hunting is rather widespread among predatory fishes. Perhaps it prevails over other types of prey capture because it is efficient and requires less energetic expense than would an active chase of an escaping victim. In the pelagic environment it is hardly possible to use ambush tactics owing to the character of the pelagic environment, i.e. the absence of natural shelters. Therefore for those fish unable to use high-speed cruise swimming, the method of hunting may be that of lying motionless or slowly sneaking up on the prey and then making a violent rush to catch the prey. For the lancetfish in our study, we suggest that the tuna swam by the motionless or slowly swimming lancetfish at a distance appropriate for a rush but also close enough, so that the tuna was unable to react to or evade the attack.

Obvious lateral damage of the tuna's body may indicate that the lancetfish attacked the tuna in the vertical position either from the belly or from the back. Similar foraging behavior has been suggested for *Anotopterus pharao*, another aulopiform fish that resembles *Alepisaurus* in physical shape and structure, habitat, and diet (Balanov and Radchenko, 1998).

Several of our colleagues suggested that the tuna may have been dead when the lancetfish seized it. Starvation, or if the tunas was a discard from a fishing vessel, and other reasons were given as the cause of mortality. However, in the area of the longline set by the research cruise, and in the general vicinity of the survey, no commercial longline or tuna purse-seine vessels were spotted. We believe that the lancetfish made a successful natural attempt to seize a large, fast swimming food item. If, indeed this was the case, the finding is new and expands our knowledge of lancetfish biology. It also indicates the efficiency of ambush-rushing type of hunting and the ability of a species unable to cruise at high speeds to catch rather large fast-swimming fishes.

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