A METHOD OF SIMULTANEOUSLY TAGGING LARGE OCEANIC FISH AND INJECTING THEM WITH TETRACYCLINE

A simple method of marking large oceanic fish such as yellowfin tuna, *Thunnus albacares*, and wahoo, *Acanthocybium solandri*, for age determination studies is described. The method, developed for tagging and injection with tetracycline of yellowfin tuna >45 kg from the deck of sport fishing vessels, is easily adaptable to other species, including billfish and possibly marine mammals.

The use of calcium-specific markers, such as oxytetracycline (OTC), to validate the temporal significance of natural marks in hard parts has become increasingly widespread. Validation is recognized as a basic requirement of age and growth studies (Beamish and McFarlane 1983). OTC is usually administered orally, intraperitoneally, or intramuscularly (Weber and Ridgway 1967; Wild and Foreman 1980; Campana and Neilson 1982). Boating and restraining while OTC is injected causes stress and trauma to the fish and may result in injury to the tagger when large, powerful pelagic fish are tagged. Nevertheless, biologists from the Inter-American Tropical Tuna Commission (IATTC) have successfully tagged and injected medium-sized (up to 36 kg) yellowfin tuna (Anonymous 1982) where, using multiple poles (two pole method, described in Godsil 1938), the crew pulled the fish onto the padded aft deck (Bayliff and Holland 1986) of a dedicated tuna baitboat. Although this method would probably suffice when tagging even larger fish, dedicated vessels are costly and there is no guarantee of locating adequate-sized fish during the charter period. Opportunistic tagging by the crews of long-range sportfishing boats, which frequently capture large tuna but lack gear to handle live fish on deck, was an attractive prospect.

Methods and Materials

A device used for administering drugs to zoo animals (Extend-O-Jector[1], model A, Kay Research Products, Hyde Park Bank Bldg., Suite 503, 1525 East 53rd St., Chicago, IL 60605 USA) was modified (Fig. 1) by adding a stainless steel dart tag applicator held at an appropriate distance with 13 mm thick PVC sheet press-fitted to the distal end of the injector head. The applicator was then fastened to the grooved base of the injector head with a hose clamp, stabilizing it during use. Other types of applicators, such as those used for metal anchor tags (Bayliff and Holland 1986) can be easily substituted. Depending on the tag type, a rubber band may be used to hold the tag in place during application.

The device utilizes either a 3 to 5 cc disposable syringe and a 2-in (51 mm) needle. For tunas, a 17 gauge needle provided the best combination of sufficiently high delivery rate and minimum puncture diameter.

As the decks of most long-range sportfishing boats are quite far off the water (2 m), the device was bolted inside a 25 mm ID telescoping tubular aluminum pole, the type normally used with swimming pool cleaning equipment. The length may then be adjusted to suit individual situations.

When a large tuna was captured by an angler, the tag and injection was administered below the second dorsal fin while the fish was still in the water. Through trial and error, application was found most efficient when the device is continuously pushed toward the fish's body after initial insertion of the applicator needles. Best results are obtained when the device is kept as near to perpendicular to the body of the fish as possible, preventing the needles from bending, damaging the fish, or both. The fish is released by removing the hook by jerking the bend of the hook with a gaff forwards while pulling the line backwards, or cutting the leader as close to the hook as possible. Under certain conditions, free-swimming fish found at the surface may be tagged and injected.

A previous experiment (unpubl. data, Inter-American Tropical Tuna Commission, La Jolla, CA) determined that doses as low as 10 mg/kg body weight formed readable marks in the vertebrae of mackerel, *Scomber japonicus*. Wild and Foreman (1980) and Foreman (1987) determined that a dosage of 27 mg OTC/kg body weight formed a brilliant mark in the otoliths of yellowfin and skipjack, *Katsuwonus pelamis*, tunas and in otoliths and vertebrae of bluefin tuna, *Thunnus thynnus*. For large fish (near 45 kg), the volume required using standard veterinary injectable (100 mg/mL) OTC would be unmanageable; a more concentrated form (200 mg/mL; Pfizer Liquamycin LA-200) was substituted. Because the marks formed in smaller fish were sufficiently bright, the dose was reduced by half, to about 13.5 mg/kg.

[1]Reference to trade names does not imply endorsement by the National Marine Fishers Service, NOAA.

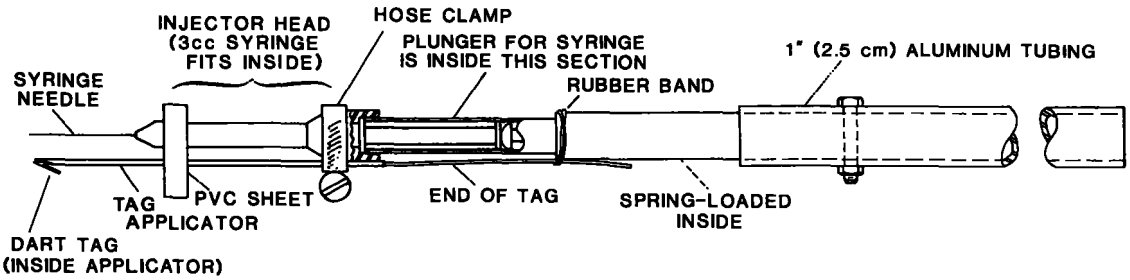

FIGURE 1.—A tag and injection device for large pelagic fish.

Results and Discussion

On the night of 27-28 January 1986, the crew and passengers of a 34 m long-range sportfishing boat, *Royal Polaris*, tagged, injected, and released 36 yellowfin tuna, all estimated to be >45 kg. Six of these fish were recaptured from 14 to 83 days later, indicating that the tagged fish were active and feeding.

Differences in return rates between this method and the padded deck method (Table 1) are possibly due to such factors as differences in size and age of the fish tagged, fishing effort in the tagging area, or the amount of stress caused by different fishing methods, rather than some characteristic of the pole method.

The otoliths from recaptured fish displayed the yellow-green fluorescent mark when viewed under ultraviolet light, but the marks appeared much fainter than those on otoliths returned from the program which used a padded deck. Since the dosage each fish received was monitored by the amount (if any) left in the syringe after application, failure of the device to deliver the full amount of OTC was ruled out. Similarly, the needle size was nearly the same for both treatments, and pore seepage is assumed equal. There were, however, differences in the type of OTC used. Liquamycin LA-200, used with the pole device, was found to contain a slow-release agent (2-pyrrolidone) which extends the antibiotic effect over time. Evidently the agent also slows deposition of the fluorophors such that their concentration in the area of osteogenesis and hence the brilliance of the mark is diminished. I recommend that an OTC solution without slow-release agents be used, e.g., Anchor Oxy-Tet 100, as in previous experiments.

TABLE 1.—Comparison of tag return rates from the padded deck method (unpubl. data, Inter-American Tropical Tuna Commission, La Jolla, CA) and pole injection device method for yellowfin >100 cm (20.5 kg) at release.

	Releases	Returns	Percent
Padded deck	49	16	32.7
Pole device	36	6	16.7

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SECOND RECORD OF THE KAWAKAWA, *EUTHYNNUS AFFINIS*, FROM THE EASTERN PACIFIC OCEAN

Although the kawakawa, *Euthynnus affinis* (Cantor 1849), is widely distributed throughout the warm waters of the Indo-West Pacific (Yoshida 1979), it is replaced by the black skipjack, *E. lineatus* Kishinouye, in the eastern Pacific. There is only one previous record of *E. affinis* in the eastern Pacific. That specimen, 361 mm fork length (FL), was reported from Los Angeles Harbor, CA, in 1952 (Fitch 1953). The second documented occurrence of *E. affinis* from the waters of the eastern Pacific is recorded in this note.

The specimen, *E. affinis*, 920 mm FL and 13.15 kg, was caught by Ronald Nakamura using hook and line from the long-range San Diego-based sport-fishing boat, *Royal Polaris*, on 17 December 1986, off Clarion Island (lat. 18°22'N, long. 114°44'W) in the Revillagigedo group. The specimen has been deposited in the Scripps Institution of Oceanography fish collection (SIO 87-70).

The morphometric and meristic characters for the specimen are given in Table. 1. The measurements were taken according to the methods of Godsil and Byers (1944) and Gibbs and Collette (1967). The external characters of this specimen agree with Godsil's (1954a) description of the species. The wavy oblique markings on each side of the dorsal surface, no dip in the lateral line below the second dorsal fin, and the several black to gray spots scattered over a relatively wide area between the pectoral and pelvic fins are characteristic of most specimens of this species. Furthermore, the morphometrics for this specimen are within the ranges for those body proportions reported by Godsil (1954b) and are closer to the morphometrics for *E. affinis* from Hawaii, rather than from Japan.

The internal characters also appear to agree with Godsil's (1954a) description of the species. High-quality radiographs produced by computer-assisted tomography (C.A.T.) scanning equipment were utilized for examing skeletal characters. The vertebral count is 20 + 19 = 39, and the radiographs showed no bony protuberances on any of the caudal vertebrae. However, no vomerine teeth were present. Although there was no indication of their previous presence, their absence could be explained by wear in this presumably old specimen. Nevertheless, the primary characters distinctive of *E. affinis*, 39 vertebrae, the total gill raker count of 31, and the absence of bony protuberances on the caudal vertebrae, leave no doubt on the identity of this specimen.

The occurrence of *E. affinis*, as well as the first documented occurrence of this specimen in the eastern Pacific, should be considered extremely rare events. No specimens of *E. affinis* were noted, during 1980-82 while personally examining a few thousand specimens of *E. lineatus* landed by commercial tuna vessels operating in the eastern Pacific. One of the remarkable fea-

TABLE 1.—Summary of morphometric and meristic data. The measurements are in millimeters.

Character	Measurements (mm)
Fork length	920
Head length	263
Snout-first dorsal	301
Snout-second dorsal	552
Snout-anal	590
Snout-ventral	291
Max. body depth	232
Max. body width	156
First dorsal-ventral	225
First dorsal-anal	385
Ventral-vent	310
Base first dorsal	238
Base second dorsal	72
Base anal	61
Pectoral length	138
Anal length	65
Diameter of iris	29
Maxilla length	97
Snout-posterior of eye	106
	Counts
Dorsal spines	15
Second dorsal rays	13
Dorsal finlets	8
Anal rays	14
Anal finlets	7
Pectoral rays	26
Gill rakers	8 + 1 + 22 = 31