Capturing and Restraining Technique for Experimental Work on Small Tuna in Large Laboratory Holding Tanks

Our recent studies on induced spawning of captive tuna at the Kewalo Research Facility (National Marine Fisheries Service, Southwest Fisheries Center, Honolulu Laboratory) have required new methods of handling these fish and minimizing injury. Since our procedures (Kaya et al. 1981; 1982) involve periodic gonadal biopsies of live fish, as described by Shehadeh et al. (1973) the fish must be kept immobile while gonadal tissue is extracted by a catheter inserted into the urogenital aperture. Such procedures must be effected without traumatizing the fish seriously enough to prevent their subsequent spawning. The tunas used in this experiment were kawakawa (*Euthynnus affinis*) and skipjack (*Euthynnus pelamis*) 40 to 50 cm (15.7 to 19.7 inches) in length and 1.2 to 3.2 kg (2.6 to 7.0 lb) in weight. They were held in groups of up to 20 in 7.3 m (24 ft) diameter by 1.1 m (3.6 ft) deep holding tanks. Fast and powerful, these fish are difficult to capture from holding tanks and to physically restrain them for any manipulative purposes usually causes serious and often fatal harm. Lacking protective scales on their skins, the fish are readily bruised by any but the most gentle contact and their caudal fins are easily frayed. Attempts to restrain them often produce internal injuries which may result in death within a few days, and survivors are prone to develop an apparently stress-related condition referred to as "puffy snout." This condition obviates their usefulness as experimental specimens and is eventually fatal.

Preliminary experimentation eliminated the use of anesthesia as a satisfactory approach for working with more than a few tuna at a time. The fish can be injured by handling associated with the administration of an anesthetic. In addition, as obligatory ram ventilators they must pass water over their gills by moving forward with their mouths open. Tunas anesthetized deeply enough for the biopsy procedure must then be nursed until they are capable of coordinated swimming. This process is time consuming and increases handling of each specimen.

To capture these fish from holding tanks and manipulate them with minimal injury, we developed procedures to: (1) prevent contact between fish and abrasive surfaces during the capture and biopsy processes; (2) immobilize each fish sufficiently to effect the catheterization; (3) permit rapid processing of each specimen; and (4) allow the sequential handling of every specimen in a holding tank.

The capture system (Fig. 1) was designed to force a fish to swim into a transparent capture sac. The capture sac was made from transparent polyethylene sheeting, 0.15 to 0.25 mm (6 to 10 mils) thick, cut to size and shape and

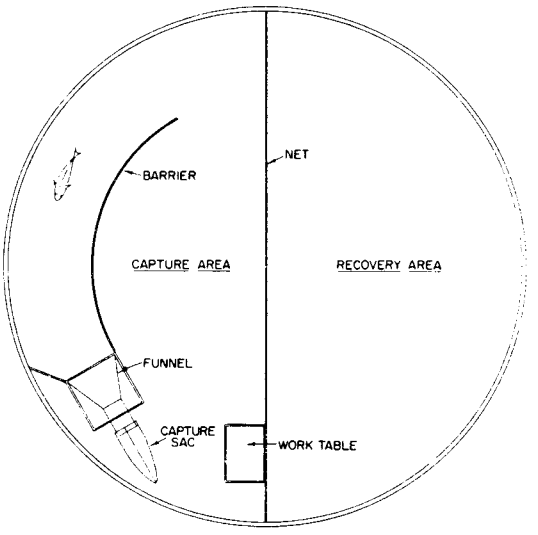

Fig. 1. Capture system.

heat-sealed along the edges (Audion Electronics[1] sealer obtained from Packaging Aids Corp.[1], 469 Bryant Street, San Francisco). Dimensions of the capture sacs were determined by constructing prototypes around similar-sized, dead specimens obtained from commercial sources. A tapered enclosure was formed between the plastic-lined wall of the holding tank and a portable curved barrier. The enclosure led into a funneling chamber which terminated at the capture sac. The barrier measured 0.60 × 3.05 m (2 × 10 ft) and was made of opaque polyethylene sheeting attached around a rigid polyvinyl chloride (PVC) pipe frame. The frame was bent to conform to the curvature of the tank (Fig. 1), by the inclusion of 45° elbows along its length. The funneling chamber (Fig. 2) had a 0.61 × 0.61 × 0.91 m (2.0 × 2.0 × 3.0 ft) long frame supporting a cone constructed of vinyl-coated nylon fabric (Herculite[1], available at sail, awning, or canvas retailers). The narrow, distal end of the cone was attached to a rigid polyethylene cylinder 0.3 m (1.0 ft) in diameter, made by removing the bottom from a bucket.

[1]Reference to trade names or commercial sources does not imply endorsement by the National Marine Fisheries Service, NOAA.

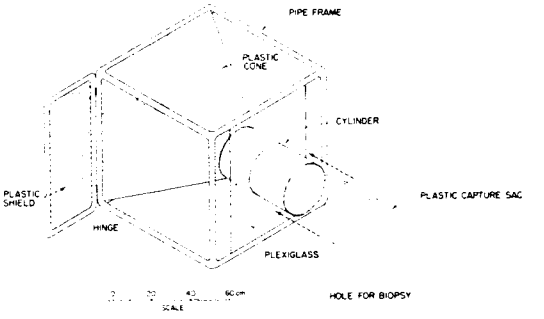

Fig. 2. Funneling chamber.

To capture fish from a holding tank, water was drawn down to a depth of about 0.6 m (2.0 ft) and the tank was divided in half with a seine (Fig. 1) All specimens were originally retained in the "capture" half. One person held the capture sac with its opening over the distal end of the funneling chamber while another used a small seine to isolate a specimen within the enclosure and forced it to swim through the funneling chamber into the capture sac. The opacity of the walls of the enclosure and the funneling cone tended to deter fish from ramming into them, and the flexible materials minimized injury when accidental contact was made. Fish generally made a dash to attempt escape through the apparently open end of the cylinder and swam into the capture sac. To lift a fish onto the restraining table (Fig. 3), the capture sac was grasped along the seamed side close to the body of the fish, and sac and enclosed fish were swung to the table in a fast, continuous motion. Grasping along the seamed side prevented tearing open of the seam from the fish's weight.

The restraining device consisted of a table padded with a layer of foam rubber and to which two strips of foam rubber and a sheet of opaque, vinyl-coated fabric (Herculite[1]) were attached along one edge (Fig. 3A). The fish, still contained within the capture sac, was placed on the padded surface and the two strips of foam were folded over its head and caudal fin. The plasticized sheet was then drawn down tightly over the fish and held in place with Velcro[1] strips (Fig. 3B). The fish was thus tightly sandwiched between layers of foam rubber and soft plastic material. Movement of the fish was minimized by this re-

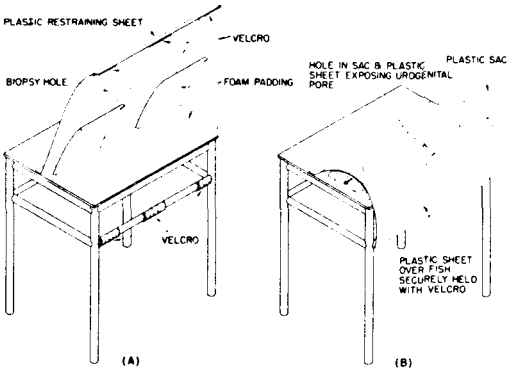

Fig. 3. (A) Restraining table. (B) Positioning of fish for gonadal biopsy.

straint and probably also by having its eyes covered by opaque material. The catheter could then be inserted through openings located in the restraining plasticized sheet and the capture sac (Fig. 3B). After processing, the fish was released into the "recovery" half of the tank and the procedure repeated on the remaining specimens in the "capture" half. To release a fish, the transfer procedure earlier described was reversed and the capture sac pulled free as the specimen was immersed.

This system allowed rapid, efficient processing of specimens with minimal trauma to the fish and with practice, procedure from catheterization to release could be executed in less than 20 seconds. When biopsied in the morning, our captive tuna often resumed feeding by the afternoon of the same day. Two groups of captive kawakawa survived monthly biopsies of 18 and 19 months in a program to monitor their gonadal maturation. Selected individuals have been successfully subjected to multiple biopsies within 48-hour periods during induced spawning trials (Kaya et al. 1981).

Although developed originally for gonadal biopsies of tuna, the system can be used on other fishes and can be modified for other purposes. We have used it successfully on jacks (*Caranx* sp.) and dolphinfish (*Coryphaena hippurus*). A second opening, not depicted in Fig. 3B, is made in the restraining sheet and capture sac to allow access to a selected area on the dorsal surface of restrained specimens. This second opening is used to place identifying marks on individuals, using the silver nitrate technique described by Thomas (1975), or to administer hormone injections.

References Cited

Kaya, C. M., A. E. Dizon, and S. D. Hendrix. 1981. Induced spawning of a tuna, *Euthynnus affinis*. Fish. Bull. 79:185–187.

Kaya, C. M., A. E. Dizon, S. D. Hendrix, T. K. Kazama, and M. K. K. Queenth. 1982. Rapid and spontaneous maturation, ovulation, and spawning of ova by newly captured skipjack tuna, *Katsuwonus pelamis*. Fish. Bull. 80:393–396.

Shehadeh, Z. H., C.-M. Kuo, and K. K. Milisen. 1973. Validation of an *in vivo* method for monitoring ovarian development in the grey mullet (*Mugil cephalus*. L.) J. Fish. Biol. 5:489–496.

Thomas, A. E. 1975. Marking channel catfish with silver nitrate. Prog. Fish-Cult. 37:250–252.

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