

Table 1. Results of sexing a sample of *Thalassoma duperrey* using the techniques of abdominal pressure and catheterization.

	Gametes Obtained via Abdominal Pressure		Fish Catheterized			Total
			Catheter Did Not Enter	Catheter Entered		
	Ripe Ova	Milt (Sperm)		Oocytes Not Observed	Oocytes Observed	
No. of Fish	2 <sup>a</sup>	4 <sup>b</sup>	80 <sup>c</sup>	3 <sup>d</sup>	41 <sup>a</sup>	130
% of Sample	2	3	62	2	32	100

<sup>a</sup>Certain females

<sup>b</sup>Certain males

<sup>c</sup>Probable males

<sup>d</sup>Probable females

Post-catheterization mortality was not significant (only 5% of 240 fish) in a previous experiment in which female wrasses were held in captivity (Ross 1981). Much of this mortality was probably due to the effects of crowding and confinement. No delayed mortality or sublethal effects on growth or behavior were detected.

A drawback of the technique is the inability to identify males with certainty. Because the vas deferens has a very small diameter, the catheter cannot enter it and sperm samples are difficult to obtain. Table 1 summarizes the results of using both abdominal pressure and catheterization on a sample of wrasses with a male-biased sex ratio.

### Acknowledgments

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### Simple, Inexpensive Method of Tagging Ictalurid Fishes for Individual Identification

Although many methods for tagging fishes exist (Laird and Stott 1978), including methods that permit individual identification at a distance (Hauser and Legner 1976; Ran-

dolph 1976), none of the published techniques combines all the following features:

- (1) Inexpensive: Tags cost less than \$0.01 each. (2) Simple: Tags are easily fabricated,

even in the field, and require few tools to make and apply. Tag reading or detection does not require special tools. (3) Individual: Tags enable individual identification from a distance of at least 2.0 meters. (4) Rapid: One worker can apply tags rapidly. (5) Durable: Tags are retained by fishes for at least four weeks, and resist tangling and deterioration. (6) Non-damaging: Tags have minimal affects on behavior and mortality, and tag loss does not damage fishes. (7) Non-attractive: Tags do not attract the attention of other fishes.

The tag described here combines all these properties, and has been used successfully in a four-year study conducted on the reproductive ecology of the brown bullhead, *Ictalurus nebulosus* (Blumer 1982). It is similar to the vinyl streamer developed for tagging shrimp (Marullo et al. 1976), but also permits individual identification at a distance.

Materials needed to fabricate and apply these tags are shown in Fig. 1. Forestry flagging tape (Forestry Suppliers Inc.) is the tag material, upon which numbers are written with water resistant marking pens. The tag is applied by threading the long end of the tag on a large needle and pushing the needle through the dorsal musculature of the fish. The tag is pulled until the narrow part is in the dorsal musculature and the wide ends are on either side of the body (Fig. 2). Excess tagging material is then cut off, and the needle is reused. Actual tag application takes less than two minutes per fish.

During 1978–1981, more than 400 individual brown bullheads were tagged. No anesthesia was used and tagging was accomplished while holding each fish in a shallow

basin of water. Tagging appeared to have minimal effects on behavior under natural conditions. Although tagged fishes were observed attempting to scrape off their tag by rubbing against rocks and vegetation, these were atypical responses. More than half of the 78 adult fishes tagged during parental care returned to their brood upon release and were observed on subsequent days. These data are biased against the hypothesis of no effects due to tagging since the effects of capture alone may account for some brood desertion. Similarly, natural brood predation and the normal termination of parental care, when juveniles reach approximately 1.5–2.0 cm total length, must also account for some of the 34 cases in which parental care ceased after tagging. Qualitatively, the care-giving behavior of fishes observed prior to tagging was indistinguishable from that of tagged fishes. Tags could be read from distances of 2 m or more using 8× binoculars. Among 74 individuals that were repeatedly observed up to 2 weeks after tagging and release, two lost their tag. Tagging mortality, if it occurred at all, may have accounted for the death of two of these 74 fishes. Tags did not become tangled in vegetation nor did they seem to attract the attention of other fishes, based on more than 100 hours of observations on bullheads attending 28 different broods.

A total of 130 fishes were tagged with both flagging and fingerling discs (Floy Manufacturing, FTF-69). Fingerling discs were attached to both pectoral spines with vinyl thread. Twenty-three fishes were recaptured in subsequent years. Both tags were intact in seven cases, the fingerling tag alone remained

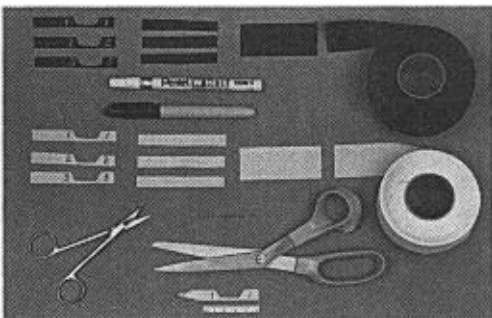


Fig. 1. Materials Needed to Make and Apply Tags.

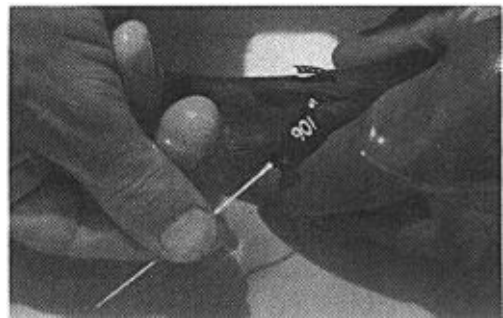


Fig. 2. Applying Tag to an Adult Brown Bullhead.

in 11 cases, the flagging alone remained in four cases, and both tags were missing, inferred from scars and characteristic damage to pectoral spines, in three cases. Although long term tagging was not a goal of this technique, the vinyl flagging did remain intact for as long as two years. This tag caused minimal inflammation at the site of insertion, unlike the fingerling discs, and on fishes that had lost their tag from the dorsal musculature, only a minor scar remained. Vinyl flagging accumulated algal growth very slowly, and numbers were easily read from a distance in the year of tagging.

Black, white, pink, and blue vinyl flagging were used with success, and this material is available in four other colors. However, yellow and orange flagging materials may be toxic as mentioned in Ben Meadows Co. 1981 catalog. The size and shape of the tags could be modified for fishes other than ictalurids. I estimate that one roll of flagging tape will yield more than 3000 tags, each the size in Fig. 1, at a cost of less than \$0.01 per 25 tags.

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## The Benthic Box: a Quantitative Sampler for Use on Soft Substrates in Shallow Water

The sampler described in this note was developed during recent studies of the seasonal density of the aquatic snail *Helisoma trivolvis* in littoral zones of several lakes and ponds (Lemly 1983). Since *H. trivolvis* burrows (Boerger 1975), samples must be collected with an apparatus that penetrates into the substrate. An Ekman dredge may prove useful but, because the depth of penetration is not consistent (Wetzel and Likens 1979), variation may result in the volume of substrate removed. A simple, manually operated sampler

was developed which minimized this error from sampling variation.

The "benthic box" (Fig. 1) was constructed of 18 gauge galvanized tin and the blade was made of 18 gauge stainless steel. The handle of the blade was formed by rolling or hammering the stainless steel around a small pipe or piece of wood. Both the blade and bottom edges of the benthic box were sharpened to facilitate penetration of the substrate. An interior partition was held in place with pop-rivets and served to stop the sampler when it reached the