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Abstract.—We injected 50 juvenile shortnose sturgeon *Acipenser brevirostrum* with sequentially numbered, standard-length, binary coded wire tags, 4 along each pectoral fin spinous ray, 1 in the base of each pectoral fin, and 1 in the base of the dorsal fin, for a total of 11 tags per fish. After 120 d, the fish were examined for tag retention at each location by means of X-rays. Retention was 98% in the dorsal fin base, 96% in the pectoral fin bases, and 78% in the pectoral fin spinous rays. However, a mean of 6.5 pectoral fin spinous ray tags per fish were retained and all fish retained at least 2 tags. Because individual tags may be recovered nonlethally by taking incremental segments of the spinous ray, the process can be repeated, thus allowing for multiple recaptures. This may be especially important for population studies on endangered species such as the shortnose sturgeon.

The internal coded wire tag (Jefferts et al. 1963) has been successfully used to mass-tag several species of salmonids (Blankenship 1990; Peltz and Miller 1990), other fish species (Dunning et al.1990; Oven and Blankenship 1993; Isely and Tomasso 1998), and several species of invertebrates (Uglem and Grimson 1995; Isely and Eversole 1998). Advantages of this tag type include ease and efficiency of use, low unit cost, high rate of retention, ability to tag large numbers of small individuals, and capacity for individual and batch identification. However, because of the typical nasal placement, recovery of these tags generally requires the sacrifice of the tagged individual. Benign recovery of coded wire tags has numerous advantages and has been successfully accomplished in rainbow trout *Oncorhynchus mykiss* by implanting the tag in eyelids and fins (Oven and Blankenship 1993). Our objective was to evaluate the retention of coded wire tags in several locations in shortnose sturgeon *Acipenser brevirostrum.* One tagging location—the pectoral fin spinous rays—was selected specifically to facilitate benign recovery.

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Methods

We obtained juvenile shortnose sturgeon from the Bear's Bluff National Fish Hatchery, South Carolina, transported them to the Aquatic Animal Research Laboratory at Clemson University, South Carolina, and stocked them into an 800-L flow-through tank. The fish were fed live black worms *Lumbriculus variegatus* ad libitum two or three times daily. We tagged 50 individuals (104 ± 2.6 mm total length [mean ± SD]; 9.2 ± 3.43 g) with sequentially numbered, standard length, binary coded tags using a Mark VI Coded Wire Tag Injector (Northwest Marine Technologies, Inc., Shaw Island, Washington). With a fixed needle, a single tag was injected into the base of the dorsal fin and each pectoral fin, and a row of 4 tags was injected along the length of each pectoral fin spinous ray approximately 2 mm apart and perpendicular to the axis (Figure 1), for a total of 11 tags per fish. Individual fish were examined visually and by means of a hand-held coded wire tag detector (Northwest Marine Technologies) immediately after tagging and again after 7 d for tag retention at each location. After 120 d, fish were weighed and X-rayed to positively identify and enumerate tags.

Results and Discussion

Eight fish died during the study; however, no fish died within 7 d of tagging (Table 1). Although fish may have died as a result of tagging, they were emaciated and apparently died of nutritional problems associated with poor feeding. We did not observe any fin deformities as a result of tagging. Tag retention after 7 d was 98% in the dorsal fin base, 98% in the pectoral fin bases, and 88% in the pectoral fin spinous rays. Tag retention over the 120-d study was 98% in the dorsal fin base, 96% in the pectoral fin bases, and 78% in the pectoral fin spinous rays. However, a mean of 6.5

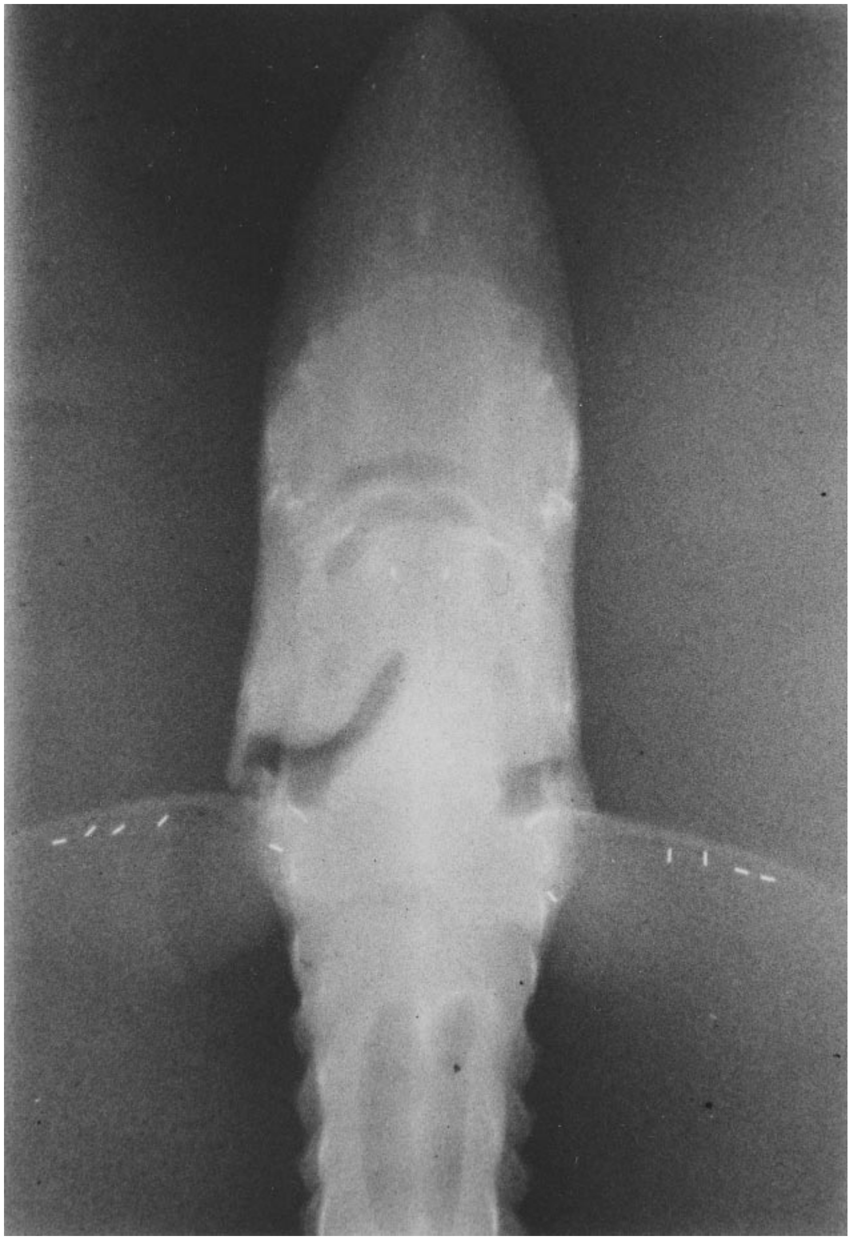

FIGURE 1.—X-ray of shortnose sturgeon tagged with four 1-mm coded wire tags in each pectoral fin spinous ray, one in each pectoral fin base and one in the base of the dorsal fin (not shown). Coded wire tags appear as white lines.

pectoral fin spinous ray-placed coded wire tags per fish were retained and 100% of the fish retained at least 2 tags (Figure 2). The 78% final retention rate for coded wire tags placed in a position facilitating benign recovery is relatively low compared with that observed by Isely and Tomasso (1998) for tags placed in the standard nasal position and with the rates observed by Oven and Blankenship (1993) for tags placed in a benign-recovery position in rainbow trout.

Although fish grew fivefold in weight over the course of the study (Table 1), the relative position of tags in the pectoral fin spinous rays did not appear to change. Because the growth of spinous

TABLE 1.—Sample size, mean total length and weight (± SD), and tag retention by tag location for surviving shortnose sturgeon tagged with multiple coded wire tags and held for 120 d.

				Tag retention (%)		
Day	*N*	Total length (mm)	Weight (g)	Dorsal fin base	Pectoral fin base	Pectoral spinous ray
0	50	104 ± 2.6	9.2 ± 3.4	100	100	100
7	50			98	98	88
120	42	242 ± 3.5	57.1 ± 23.1	98	96	78

rays is accomplished through the deposition of material on their surfaces, imbedding tags in the spinous rays probably reduced the possibility of rejection as fish grew. By contrast, the position of tags changed in rostrum-tagged paddlefish *Polyodon spathula* because of the growth of the rostrum (Waters et al. 1997).

We suggest that spinous ray-placed tags be collected by removing a distal segment of the spinous ray in the standard manner used to collect samples for age and growth analysis. By taking incremental segments of the spinous ray, individual tags may be recovered nonlethally. The process can be repeated, thus allowing for multiple recaptures. This may be especially important for population studies on endangered species such as the shortnose sturgeon.

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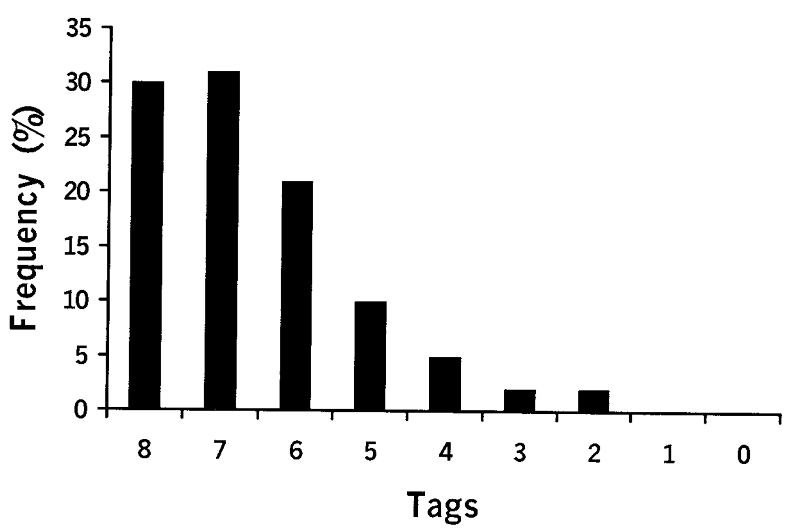

FIGURE 2.—Frequency (%) of coded wire tags retained in both pectoral fin spinous rays in individual shortnose sturgeon.

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