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USE OF AN ARTIFICIAL SUBSTRATE TO COLLECT WHITE STURGEON EGGS[1]

The white sturgeon, *Acipenser transmontanus*, is an important recreational and commercial fish in the Columbia River, Oregon and Washington. In 1988, the estimated recreational and commercial harvests of this species downstream from Bonneville Dam (the lowermost dam on the Columbia River, River Kilometer 234) were 43,100 and 6,900 sturgeon, respectively (Hess and King 1989).

Despite the economic importance of white sturgeon, there are relatively little data on its early life history in the Columbia River. Accordingly, a study was initiated in 1987 to better describe where and when white sturgeon spawn downstream from Bonneville Dam. Early in this study white sturgeon eggs were collected with plankton nets and bottom trawls (McCabe and McConnell 1988). In 1988, an egg collection system utilizing an artificial substrate was developed to sample the highly adhesive eggs of this species. This paper describes the fabrication and use of this artificial substrate system.

The collection system was constructed by cutting a roll of latex-coated animal hair (AK725R-4, manufactured by Air Kontrol, Batesville, Mississippi[2]) into 76 X 91-cm pieces and securing two back to back pieces to an angle-iron frame with strips of flat iron bar (Fig. 1). The strips of flat bar were held in place with nuts and bolts to facilitate removal of the substrate from the frame. Also, two strips of flat bar were welded in place across one side of the frame to provide additional support for the substrate. By placing the substrate pieces back to back in each frame, it made no difference which side of the frame rested on the river bottom. Two short sections (1.2 m) of 5-mm diameter cable were used to attach the frame to an anchor.

A three-fluke anchor similar to a grapnel was used to hold the substrate and frame in place on the river bottom, and proved successful in holding against strong currents on cobble-boulder bottoms. The anchor was constructed of a 30-cm section of PVC pipe (8-cm inside diameter), reinforcing steel bars (13-mm diameter), and concrete (Fig. 1). One piece of reinforcing bar was bent to form two of the anchor flukes (each fluke was about 20 cm long) and a loop for an attachment for the cables. A short piece of reinforcing bar was bent to form the third fluke and welded to the other reinforcing bar. The reinforcing bars were placed inside the PVC pipe and held in place with concrete. Total weight of the anchor was about 5.4 kg.

A buoy line (8-mm diameter) was attached to the anchor to mark the location of the substrate. Length of the line varied depending upon water depth and velocity. Artificial substrate systems were placed at depths ranging from about

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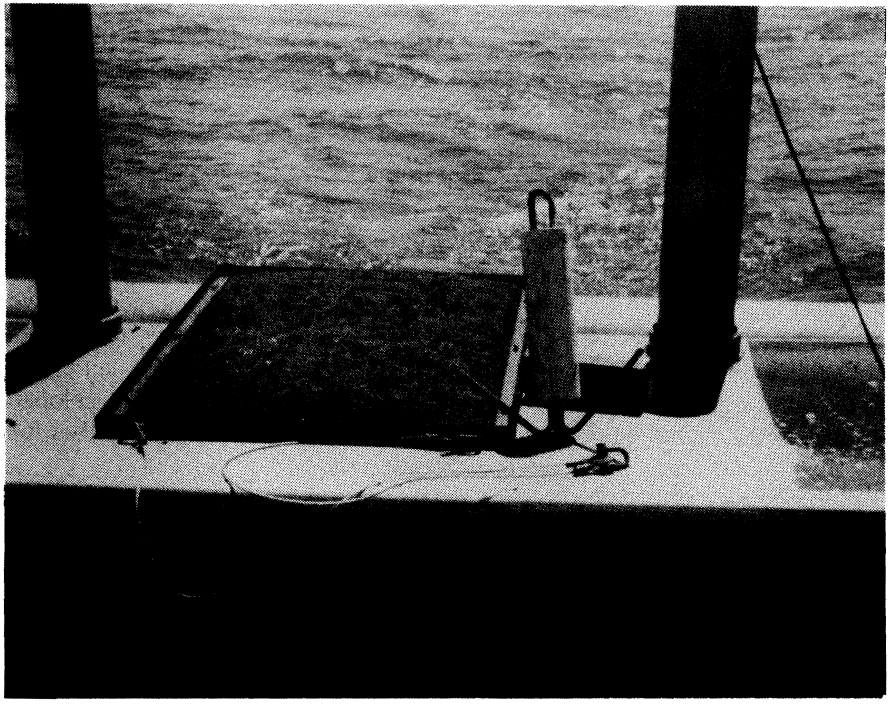
[2] Reference to trade names does not imply endorsement by NMFS or NOAA.

FIGURE 1. The artificial substrate, frame, and anchor used to collect white sturgeon eggs in the Columbia River downstream from Bonneville Dam.



3 to 15 m and surface water velocities ranging from less than 1 m/s to greater than 2 m/s. In areas where surface water velocity was greater than 1.5 m/s, the length of the buoy line was at least four times the water depth. Depending upon water velocity, three to six buoys (30-cm long and 12-cm diameter) were secured to one end of the line; more buoys were required in swift water.

In 1988 and 1989, 685 and 305 white sturgeon eggs were collected on artificial substrates deployed downstream from Bonneville Dam, respectively. Individual collections ranged from 0 to 423 eggs in 1988 and from 0 to 212 eggs in 1989. At least one egg was collected on 10 out of 22 sets in 1988 and on 7 out of 24 sets in 1989. Eggs were removed from the artificial substrate directly by hand or with the aid of a pointed instrument such as a net-mending needle. When large numbers of eggs were collected, after hand-picking, the substrate was washed with water to remove eggs that remained entangled. Eggs were preserved in a 4% or greater buffered formaldehyde solution for later estimation of developmental stages and spawning dates.

The artificial substrate is a useful tool for identifying white sturgeon spawning areas and determining timing of spawning. Ideally, both a plankton net (Kohlhorst 1976, McCabe et al. 1989) and artificial substrates should be used.

Compared to the use of a net only, artificial substrates increase the chance of detecting spawning in an area because they can be fished for extended periods. In addition, artificial substrates can be placed in areas where it may not be safe or practical to use plankton nets. For example, if artificial substrates had not been used near the spillways at Bonneville Dam, we would not have detected spawning there. Disadvantages of the artificial substrate system are its vulnerability to theft and potential for the buoy line to become entangled in the propellers of passing vessels.

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