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# Emergence Trap and Holding Bottle for the Capture of Salmonid Fry in Streams

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*Abstract.*—A 0.12-m² fry emergence trap was constructed of rigid steel strip, plumber's tape, and nylon netting. A holding bottle was fashioned from a polyethylene screw cap bottle and plastic funnel. The trap was inexpensive, durable, and effective in a wide range of current velocities. The method proved effective in estimating egg-to-fry survival rates for kokanee (*Oncorhynchus nerka*) in various sediment mixtures. Egg-to-fry survival varied from 0 to 52%, and was negatively correlated to percent fines ($r = 0.91$; $P < 0.01$). The emergence period indicated by the trap catches in McDonald Creek agreed closely with the period indicated by drift-net sampling. Fry mortality in the holding bottle was almost nil if the trap was checked at least once a week.

The estimation of egg-to-fry survival in the field is necessary for managing salmonid populations and assessing spawning area quality. Several ways of trapping have been described. Gebhards (1961) placed a trap over a chinook salmon (*Oncorhynchus tshawytscha*) redd and enumerated emerging fry. Phillips (1966) and Phillips and Koski (1969) described a nonrigid trap and collection bag designed to fit over a coho salmon (*Oncorhynchus kisutch*) redd to capture emerging fry. Porter (1973) described a rigid frame trap with a wooden fry-holding box for the capture of rainbow trout (*Salmo gairdneri*) fry, and Field-Dodgson (1983) used a similar but larger trap to capture chinook salmon fry.

The fry emergence trap described in this paper was designed to capture emerging kokanee (*Oncorhynchus nerka*) fry under a wide variety of stream depths and current velocities in the Flathead River system in northwest Montana. The trap is small, and has a rigid frame and a cylindrical fry-holding bottle. It was designed to be placed in a spawning bed; a larger version could be placed over an entire redd. The emergence trap is inexpensive, can be built quickly, and is easily and quickly installed. Because of its durability and streamlined design, the trap and holding bottle perform well in a wide variety of current velocities. The trap has been successfully used to determine the number of fry emerging from a unit area of a spawning bed, the egg-to-fry survival rates for eggs planted in the gravel, and the timing of fry emergence in kokanee spawning areas.

## Construction and Installation

The fry emergence trap is 36.8 cm square (Figure 1). The frame was constructed of hot roll steel strip (32 mm thick) fastened together with stove bolts; two strips extend 7.6 cm beyond opposite corners to allow the trap to be attached to the stream bottom. Nylon netting (1/16 in ACE, four meshes/cm) was held to the trap by plumber's tape bolted along the bottom of the frame. The plumber's tape and frame were painted with Rustoleum to prevent rusting and subsequent deterioration of the netting. A rib of plumber's tape was attached across the center of the trap to support the nylon netting, and electrician's tape was wrapped around the rib to reduce wear on the netting. A 15-cm overlapping net apron, designed to prevent lateral fry movement, extends around the perimeter of the trap. A sock made of the same netting material was sewn into the rear of the trap; it was designed to trail behind the trap and to channel the emerging fry into the holding bottle. A 6-cm portion of the sock was lined with canvas to provide a resting edge for the fry-holding bottle. The sock should be sewn together and attached to the trap by a seamstress or upholsterer.

The fry-holding bottle (Figure 2) was constructed from a polyethylene screw-cap bottle with the bottom cut out. A polyethylene funnel was stapled in place in the cut-out end and secured with hot melted glue. Windows were cut out of the funnel and bottle, and netting was glued over the openings to allow water to pass through. The bottle was placed inside the sock which was closed by a drawstring and cord tie. A wide rubberband was placed over the sock and positioned at the funnel end of the holding bottle. The trap was checked by removing the bottle from the sock, unscrewing the cap, and emptying the bottle into a pan or bucket. Cost for the materials to build one trap was $8.00. One person constructed the trap in about 2 h and installed it in a stream in about 30 min.

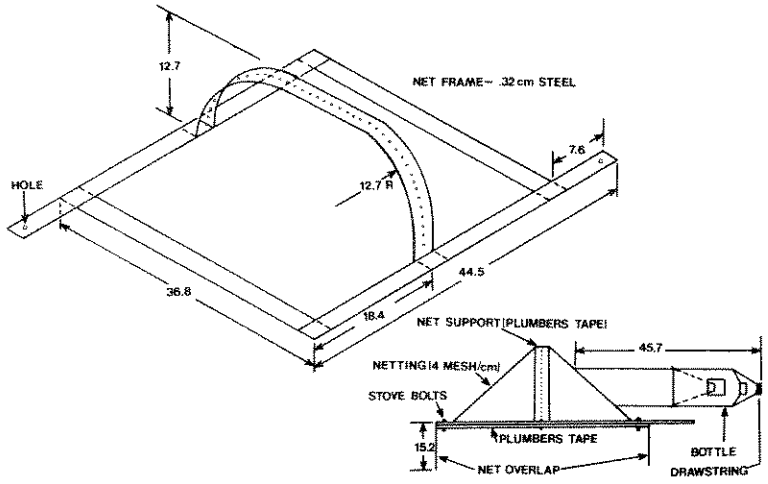


FIGURE 1.—Design of the fry emergence trap. Measurements are in centimeters; R = radius.

The trap was placed on the streambed, and a 15-cm-deep-trench was dug in the gravel around the margin of the frame to receive the overlapping net apron. The trap was attached with tie wire to metal rods driven into the stream bottom at opposite corners of the trap. Due to the deterioration of nylon netting and general wear in the current, the expected trap life is approximately 2 years.

### Evaluation of Trap Performance

Fry emergence studies were conducted in McDonald Creek in Glacier National Park, Montana, the major spawning ground for Flathead Lake kokanee. Four traps were placed over a kokanee spawning bed in McDonald Creek during the winter of 1983–1984 to monitor the number of emerging fry; they were checked twice weekly throughout the emergence period. The average density of emerging fry, calculated from trap catches, was 572/m$^2$. This figure seemed reasonable when compared to the average density of eyed eggs and sac fry (569/m$^2$) in the gravels immediately prior to the emergence period.

Five emergence traps were used in the spring of 1983 in McDonald Creek to determine the survival from eyed egg to emerging fry in various sediment–gravel mixtures. Window screen baskets containing substrate mixtures and 150 eyed kokanee eggs were fitted around the bottom of the net frames. The traps were placed in depressions dug into the stream gravels and fry emergence was monitored throughout the spring. Emergence ranged from 0 to 52% (Table 1) and was significantly correlated (inversely) with the percent fines ($r = -0.91$; $P < 0.01$). The traps were removed after emergence was complete and the contents were sieved and examined. Counts of dead fry that had not been captured by the emergence traps indicated an efficiency of 97% but this figure may be high because of the disappearance of dead fry due to decomposition. Apparently most embryo

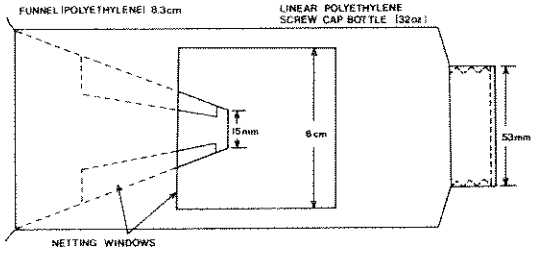


FIGURE 2.—Design and dimensions for the fry-holding bottle; 32 oz is approximately 1 L.

TABLE 1.—Emergence trap catches from 150 eyed kokanee eggs planted in various sediment mixtures.

| Trap number | Percent fine sediments (<6.4 mm) | Number of emerging fry | Percent emergence |
|---|---|---|---|
| 1 | 5 | 68 | 46 |
| 2 | 11 | 77 | 52 |
| 3 | 30 | 31 | 21 |
| 4 | 44 | 40 | 27 |
| 5 | 57 | 0 | 0 |

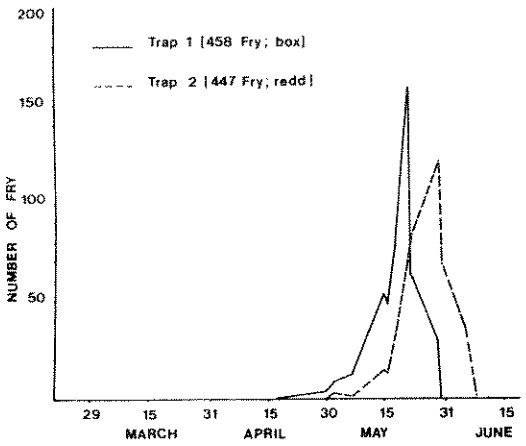


FIGURE 3.—Emergence trap catches from two plants of 1,000 eyed eggs in the mainstem of the Flathead River during the spring of 1984.

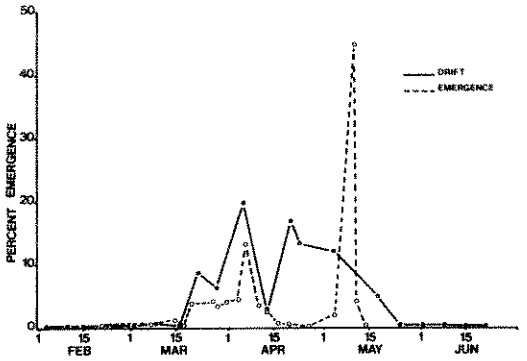


FIGURE 4.—Kokanee fry emergence period in McDonald Creek, as indicated by drift-net sampling and emergence trap catches, spring 1984.

mortality had occurred before hatching. The emergence trap also was successfully used to test egg-to-fry survival in imprint plants of 1,000 eyed eggs in areas of the Flathead River. Trap catches provided both timing information and percent survival in two of the plants of 1,000 eyed eggs (Figure 3).

The trap has been very effective in determining fry emergence timing under a wide variety of conditions. The emergence period indicated by the trap catches in McDonald Creek agreed closely with the period indicated by drift-net sampling near the mouth of the creek during the spring of 1984 (Figure 4). The emergence trap was the best method of determining the fry emergence period in unconfined spawning areas in the mainstem of the Flathead River. Water level fluctuations, channel configuration, and drift from upstream areas made determination of the emergence period impossible using drift nets. Mortality of fry in the holding bottle was almost nil if the trap was checked at least once a week. The streamlined trap and holding bottle performed well in water velocities ranging 0–1.5 m/s, with virtually no fry mortality.

### Acknowledgments

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