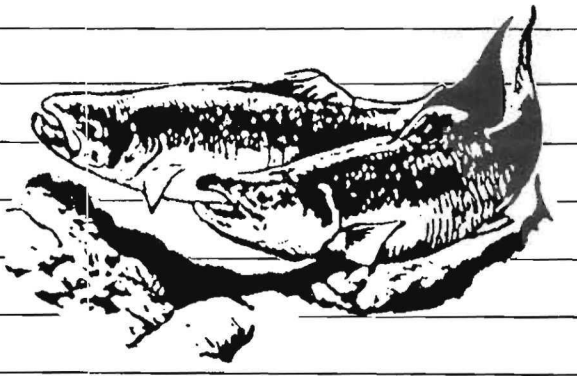
Research



Information bulletin

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL BIOLOGICAL SURVEY

NO. 3
DATE 1994

Colder Water 15 Days After Fertilization Enhanced Survival of Cutthroat Trout

Published studies have indicated that prolonged incubation at low water temperatures lowers the survival of salmonid species. We investigated the effect of fertilizing eggs and maintaining embryos at optimum temperatures for various durations before cooling. Our objectives were to determine whether the survival of cutthroat trout (*Oncorhynchus clarki*) embryos fertilized at 7°C differed when we reduced temperatures to 3 or 5°C at 2 h, 15 d, 25 d, or 35 d after fertilization and to compare these results with the survival of embryos incubated at 7°C throughout development.

Sexually mature adult fish were spawned with the dry method. Water-hardened eggs were incubated in lots of 100 with four replicates of each treatment. Embryos incubated at 7°C were acclimated to lower temperatures at 1°C/h.

The mean survival to hatching and to the swim-up stages differed significantly among embryos incubated at 3, 5, and 7°C (Table). Survival of embryos was lowest at 3°C 2 h after fertilization. Survival was highest for embryos chilled to 3°C after incubation at 7°C for 15 d.

A reduction in survival with increased time to hatching was associated with declining incubation temperatures when cooling occurred 2 h after fertilization. This was similar to other experiments. However, survival was high when the embryos were cooled 15 d after fertilization and close to the eyed stage of development. Cooling cutthroat trout embryos to 3°C after 15 d extended the mean time to hatching by 31 d beyond that observed at 7°C and also enhanced survival by 15%. Delaying temperature reductions for several days beyond fertilization may provide substantial benefits to hatchery managers.

For further information contact:

Wayne A. Hubert
Wyoming Cooperative Fish and Wildlife
Research Unit
University of Wyoming
Box 3166, University Station
Laramie, WY 82071
(307) 766-5415

Table. Mean survival of cutthroat trout (*Oncorhyncus clarki*) embryos to hatching and to swim-up stages under varying water temperature regimes. Standard deviation in parentheses.

Incubation temperature (°C)	Time to cooling (days)	Time to hatching (days)	Survival (%)	
			Hatching	Swim-up stage
3	0	97	36.3 (6.9)	19.7 (8.5)
	15	76	93.5 (1.9)	89.7 (2.5)
	25	68	91.0 (4.5)	86.4 (6.1)
	35	59	81.0 (0.8)	76.7 (1.6)
5	0	74	87.8 (5.1)	77.5 (4.7)
	15	68	89.5 (6.0)	84.4 (7.4)
	25	59	81.0 (4.2)	76.4 (4.0)
	35	55	76.0 (3.7)	73.3 (4.2)
7	0	45	79.3 (1.7)	76.9 (1.9)