



Fact Sheet No. 29:
Fishery Habitat:
4) Dissolved Oxygen



Dissolved oxygen (DO) is critical to fish survival. The saturation concentration of oxygen is determined by water temperature and atmospheric pressure (elevation). Dissolved oxygen is directly related to atmospheric pressure and inversely related to water temperature. The maximum amount of DO that water will hold is 14.7 parts per million (ppm) or 14.7 milligrams per liter (mg/l) at sea level and 32F. Sources of DO include aeration, inflow of turbulent water, and photosynthesis by aquatic plants. Dissolved oxygen can be depleted through respiration (from fish and aquatic plants), decay of organic matter, direct chemical oxidation, and outflow of water (Brown, 1985).

Management activities that remove riparian vegetation that add sediments and nutrients or that alter natural processes may influence DO levels. Most of these activities indirectly affect DO concentrations. For example, riparian vegetation removal may result in increased solar radiation input (sunlight) which increases water temperature. Increased water temperature will decrease DO concentrations. Increased organic sediment and nutrients will increase microscopic organism growth and decomposition rates, which may deplete DO.

An adequate supply of dissolved oxygen is important to fish during all stages of life. If DO levels are inadequate during incubation the embryos may be smaller throughout development, die, or hatch late or prematurely (Reiser and Bjornn, 1979). Growth will decline in juvenile salmonids when DO levels are below 5 ppm, and death occurs at less than 1-2 ppm of DO (Brown, 1985). In adults a decrease in performance (swimming speeds, ability to avoid predators, etc.) occurs at DO levels less than 6.5-7.0 ppm (Reiser and Bjornn, 1979). For spawning fish DO levels should reach at least 80% saturation, with temporary levels no lower than 5.0 ppm (Reiser and Bjornn, 1979). The response of fresh water salmonids to different concentrations of DO is shown in Table 1.

Table 1. Response of freshwater salmonids to different saturation levels at three concentrations of dissolved oxygen (DO).

| Response | DO (ppm) | Saturation at Given Temperatures (F) | | | | | |
|--------------------------------------|-------------|---|----|----|----|----|----|
| | | 32 | 41 | 50 | 59 | 68 | 77 |
| | | ----- Percent ----- ----- | | | | | |
| Function without impairment | 7.75 | 76 | 76 | 76 | 76 | 85 | 93 |
| Initial distress symptoms | 6.00 | 57 | 57 | 57 | 59 | 65 | 72 |
| Most fish affected by lack of oxygen | 4.25 | 38 | 38 | 38 | 42 | 46 | 51 |

Source: Adapted from Reiser and Bjornn (1979)

Note: Milligram per liter (mg/l) is approximately equal to parts per million (ppm).

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References

Brown, G.W. 1985. Forestry and Water Quality. College of Forestry, Oregon State Univ. Publ. OSU Bookstores, Inc., Corvallis, OR. 142 pp.

Reiser, D.W., and T.C. Bjornn. 1979. 1. Habitat Requirements of Anadromous Salmonids. *In*: Meehan, W.R., Technical Editor. Influence of Forest and Rangeland Management on Anadromous Fish Habitat in the Western United States and Canada. USDA Forest Service GTR PNW-96. 54 pp.

Note: This fact sheet only contains general information about fishery requirements. Additional sources of information include *Pacific Salmon Life Histories*, edited by C. Croot and L. Margolis, UBC Press, Vancouver. For information on specific species see *Habitat Suitability Information: for species interested in...*, published by U.S. Department of Interior, Fish and Wildlife Service. See your local fishery biologist for information about fish in any specific stream.

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