David R. Bernard[1]
and
Eugene K. Israelsen
Utah Water Research Laboratory
Utah State University
Logan, Utah 84322

Inter- and Intrastream Migration of Cutthroat Trout (Salmo clarki) in Spawn Creek, a Tributary of the Logan River, Utah

Abstract
We investigated inter- and intrastream movements of fluvial cutthroat trout (*Salmo clarki*) within Spawn Creek and between this stream and the Logan River, Utah. From November 1973 through November 1975, we captured all migrants with a fish trap on Spawn Creek and tagged adult cutthroat trout. Monthly from July 1973 through November 1975, we electrofished parts of Spawn Creek and cold-branded all unmarked juveniles and adults. Also, we continuously measured water temperature and stream flows at the trap. During the spawning season in 1974, 39 cutthroat trout entered Spawn Creek and 23 left; and in 1975, 77 fish entered and 71 left the stream. Spawning migrants entered Spawn Creek when spring freshets from melting snow increased stream flows and turbidity. Tag returns from fishermen indicated adult cutthroat trout traveled to the Logan River after leaving Spawn Creek. In 1974, 229 and in 1975, 359 cutthroat trout fry left Spawn Creek in early fall when dwindling stream flows reduced habitat along stream margins. Migratory patterns of adults and fry show cutthroat trout use Spawn Creek for spawning and the Logan River for growing. Spawn Creek contains extensive spawning habitat with little deep-water habitat while the Logan River is its complement. In 1974 and 1975, respectively, 30 and 13 cutthroat trout (age 1 and older) constituted fall runs into Spawn Creek. Intrastream movements of cutthroat trout within Spawn Creek were extensive, with 35 percent of recaptured fish having moved from where released.

Introduction

Fluvial cutthroat trout (*Salmo clarki*) do not migrate in some watersheds (Diana and Lane, 1978; Miller, 1957) but do in others (Averett and MacPhee, 1972; Bjornn and Mallet, 1964; Kiefling, 1978; Wyatt, 1959). Whether migration occurs largely depends upon the distribution of spawning habitat. For example, in the upper Snake River, high flows and silt limit spawning in the river proper, while tributaries supply suitable spawning habitat (Kiefling, 1978). In contrast, Gorge Creek, Alberta, has ample spawning habitat and no migration (Miller, 1954; 1957).

In those watersheds with migrating fluvial cutthroat trout, the migratory pattern is basically the same. Tributaries are used as spawning and rearing areas, and main-stem rivers for growth and maturation. However, some deviations in the pattern occur from one watershed to another (Averett and MacPhee, 1972; Bjorn and Mallet, 1964; Hayden, 1967; and Wyatt, 1959). The triggering factor for migration differs from area to area. In Lookout Creek, cutthroat trout did not move until water temperatures in tributaries surpassed 5°C (Wyatt, 1959). In the upper Snake River, small trout left tributaries in winter during low air temperatures (Hayden, 1967). In Idaho streams, cutthroat trout migrate with greater frequency during high flows (Gebhards and Fisher, 1972).

---
[1]Present address Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, Alaska 99502.

NOTES

Relative Roles of Food Abundance and Cover in Determining the Habitat Distribution of Stream-Dwelling Cutthroat Trout (*Salmo clarki*)[1]

Margaret A. Wilzbach

Center for Environmental and Estuarine Studies, Appalachian Environmental Laboratory, University of Maryland, Frostburg State College Campus – Gunter Hall, Frostburg, MD 21532, USA

Wilzbach, M. A. 1985. Relative roles of food abundance and cover in determining the habitat distribution of stream-dwelling cutthroat trout (*Salmo clarki*). Can. J. Fish. Aquat. Sci. 42: 1668–1672.

Emigration of wild cutthroat trout (*Salmo clarki*) from laboratory channels over 1-wk trial periods was greater under conditions of low than high food abundance (5 vs. 15% of total trout biomass daily), irrespective of the amount of cover (simulated cover structures added vs. removed). When food abundance was high, emigration of trout was slightly greater under conditions of low than high cover. Cover had no effect on emigration rate when food abundance was low. Trout occurred in association with cover structures when food abundance was high, but not when food abundance was low. These experiments suggest that at summer temperatures, food abundance overrides cover in determining the abundance and microhabitat distribution of adult cutthroat trout within a stream.

L'émigration de la truite fardée (*Salmo clarki*) sauvage de bassins expérimentaux au cours d'expériences d'une semaine était plus élevée dans des conditions de faibles concentrations de nourriture qu'en présence de fortes concentrations (5 vs 15 % de la biomasse totale de truites quotidiennement), indépendamment de la quantité d'abri (couverture simulée ajoutée vs enlevée). Quand la quantité de nourriture était élevée, l'émigration des truites était légèrement plus élevée dans des conditions de faible couverture qu'en présence d'une couverture élevée. Par contre, la couverture n'avait aucune incidence sur le taux d'émigration quand la quantité de nourriture était faible. La truite était présente sous les abris quand la quantité de nourriture était élevée, mais non quand celle-ci était faible. Ces expériences portent à croire qu'aux températures estivales, la quantité de nourriture a plus d'importance que la couverture dans la détermination du nombre de truites fardées adultes présentes dans un cours d'eau et de leur répartition dans les micro-habitats.

Received February 8, 1985
Accepted June 20, 1985
(J8113)

Reçu le 8 février 1985
Accepté le 20 juin 1985

Habitat features, including overhead shading and substrate complexity or associated crevices, have been demonstrated to reduce foraging efficiency of stream fishes, presumably by impairing detection of prey (Ware 1973; Wilzbach and Hall 1985). However, because these features also provide shelter from predation and/or physical disturbances, a trade-off may exist between potential benefits of cover and the cost in reduced foraging gain. Experimental elimination of substrate crevices, for example, increased foraging efficiency of cutthroat trout (*Salmo clarki*) relative to that found for trout in control pools, but probably resulted in an increased mortality (Wilzbach 1984). Dill (1983) reviewed considerable empirical evidence suggesting that fish may be able to adjust habitat use and foraging behavior so as to adaptively balance risks and rewards.

Difficulties in incorporating predation risk into models of foraging behavior or habitat use arise because the units of measurement (i.e. risk of mortality vs. energy or nutritional gain) are not comparable, and Dill (1983) has proposed that one possible solution may lie in observation of fish response to a variety of risk/reward combinations. The choices made by the fish provide a biologically relevant basis for weighting the two factors. In a recent experimental test that followed this approach, Werner et al. (1983) demonstrated that, in the presence of a predator (largemouth bass, *Micropterus salmoides*), small bluegill (*Lepomis macrochirus*) in artificial ponds grew more slowly and restricted their habitat use to areas of low foraging profitability.

Research findings that cutthroat trout are more numerous in cover-poor, logged streams of the Oregon Cascades than in forested streams with abundant cover (Aho 1977; Murphy and Hall 1981; Murphy et al. 1981; Hawkins et al. 1983), and tha

[1]Riparian Contribution No. 20.

Fishery Field Trip FW 304
June 7-13, 1981

Format

Meet in Forestry parking lot at 9 A.M., Sunday, June 7. Bring boots or waders for field work. Hopefully, we will be blessed with fine weather, but it is not unusual to have snow and miserable conditions in June in the higher elevations in Wyoming. Be prepared with warm sleeping bag and proper clothes. We will attempt to economize by camping and preparing most of our meals. I will purchase food to take along and we will share costs (about $10 each). We will have milk, coffee, and punch for drinking. Bring other beverages and food of your own preference if you want.

We will travel to Lander, Wyoming on Sunday and meet with Wyoming Game and Fish and USFWS biologists Monday and perhaps Tuesday morning. Plans are to arrive in Yellowstone Park by Tuesday evening (a campground has been reserved for us). We will have a briefing on the habitat model that we will field test, Tuesday evening, then spend all day Wednesday doing field work to obtain data for the model. We will plan to finish on Thursday, hopefully, after we have an opportunity to see how accurately the habitat model predicted trout biomass in a stream.

On Friday we will proceed to the Bear River drainage near Cokeville to observe the results of habitat rehabilitation work and the practical application of the Wyoming Game and Fish Departments, Habitat Quality Index. We will also learn about multiple use problems on BLM lands. This area is part of the overthrust belt and presently undergoing intense exploration for gas and oil.

We can return to Fort Collins late Friday night or on Saturday.

Primarily, of course, the field trip is a learning experience. You may bring fishing tackle in the hope of finding some time for angling, but I can not guarantee that we will. No license is required for fishing in Yellowstone Park, but remember to obtain a permit and regulations at the entrance gate.

TRANSACTIONS of the AMERICAN FISHERIES SOCIETY

May 1979
VOLUME 108
NUMBER 3

Transactions of the American Fisheries Society 108:215–228, 1979

Quantification of Fluvial Trout Habitat in Wyoming

N. ALLEN BINNS AND FRED M. EISERMAN[1]

Wyoming Game and Fish Department
Cheyenne, Wyoming 82002

Abstract

A Habitat Quality Index (HQI) was developed to predict trout standing crop in Wyoming streams. Measurements of trout habitat were collected from 36 streams that ranged in elevation from 1,146 to 3,042 m. Average late summer stream width varied from 1.4 to 44 m, while average daily flow was between 0.6 and 1.46 m^3/second. Stream gradient ranged from 0.1% to 10%. A multiple regression analysis indicated those habitat measurements best related to trout standing crop in the study streams. Predictive models were built from these measurements. The best HQI model explained 96% of the variation in trout standing crop (multiple regression correlation coefficient $R = 0.983$), suggesting a close relationship between HQI predictions and measured trout stocks. The nine habitat attributes used in this model were late summer stream flows, annual stream flow variation, water velocity, trout cover, stream width, eroding stream banks, stream substrate, nitrate nitrogen concentration, and maximum summer stream temperature.

Fishery managers have long grappled with the problem of placing a value on fishery resources, especially in conjunction with cost-benefit analysis for proposed water development projects. Most of these efforts have attempted to assign a monetary value to the fishery resource, but the results of such endeavors have not always been realistic or successful. However, in recent years, the federal Congress has drastically changed the planning of water resource projects in the United States.

In response to the Water Resources Planning Act (Public Law 89-80), the Water Resources Council (1973) established principles and standards for planning water and related land resource projects. These rules required both economic and environmental evaluations before a water development project could be approved. Thus, for the first time, nonmonetary evaluations of fishery resources became an accepted procedure. This new approach contrasted with past practices where project feasibility was often decided solely by monetary considerations.

Procedures for nonmonetary measurement of aquatic habitats were primitive when the new rules were issued and a methodology gap soon became evident. Early attempts to develop a suitable methodology (Anonymous 1974) were too subjective and not realistic when applied to trout streams in the Rocky Mountain area.

Accordingly, a project was initiated by the Wyoming Game and Fish Department to develop, and field-test, a standard method to quantify habitat for trout streams in Wyoming. Initial results of this investigation were encouraging and a preliminary Habitat Quality Index (HQI) was developed (Binns 1978a, 1978b). Since the initial report on the HQI, additional streams have been measured and the method has been improved. In the present paper, we report on the improved HQI methodology, which was developed from habitat evaluations made at 36 study sites in Wyoming.

[1] Present address: Energy Transportation Systems Incorporated, Room 212, Petroleum Building, Casper, Wyoming 82601.