Steelhead Spawner Escapement and Habitat Utilization in Selected Scott River Tributaries, 1988

by

John R. West, Fisheries Biologist
USDA, Forest Service
P.O. Box 280
Etna, CA 96027

Introduction

Monitoring steelhead spawner escapement in upper Klamath River basin tributaries is essential to determine the relative contribution of these systems to total estimated escapement of the Klamath River. Escapement into three tributaries has been monitored annually since 1983.

The principal objective of this work is to determine habitat use rates so conclusions may be drawn relative to the efficiency of instream habitat restoration techniques.

Continuation (possibly expansion) of this work is critical to prove or disprove success of the habitat restoration and enhancement program on the ranger district. Results may aid in securing future funding for habitat work as well as help direct habitat prescriptions and prevent prescription errors. Knowledge about the relative contribution of tributary systems to overall production can be helpful in addressing difficult land management situations. This information paper is not intended to be all-encompassing, because it does not provide answers to many other significant habitat related questions (eg: what is the condition of rearing habitat). However it should be viewed as a first step in a direction which may result in better steelhead management and more informed resource management decisions.

Study Area

The systems included in the study area are tributary to the Scott River in Northern California (Figure 1). Canyon, Kelsey, and Tompkins Creeks have been monitored annually since 1983. Land ownership patterns have restricted the addition of tributaries to the Scott River program, however the Kelsey Creek artificial spawning channel has been monitored since its construction in fall 1985.

Methods

Survey streams or reaches are visited by a two person crew on a biweekly basis. Each predisgnated reach is waded by crewpersons wearing felt soled wading shoes and chest waders or wetsuits in confined streams where wading is too dangerous. Redds are identified with the aid of polarized "fishermen's glasses" and colored flagging is tied in streamside vegetation adjacent to each redd. Flagging redds in this manner prevents duplicate counts of the same redd, which is most likely in years when light or temperature conditions are not conducive to rapid algae growth. Adult spawners are tallied for each stream or reach, however relatively few fish are seen because of their short tributary residence time and elusive behavior. Separate tallies

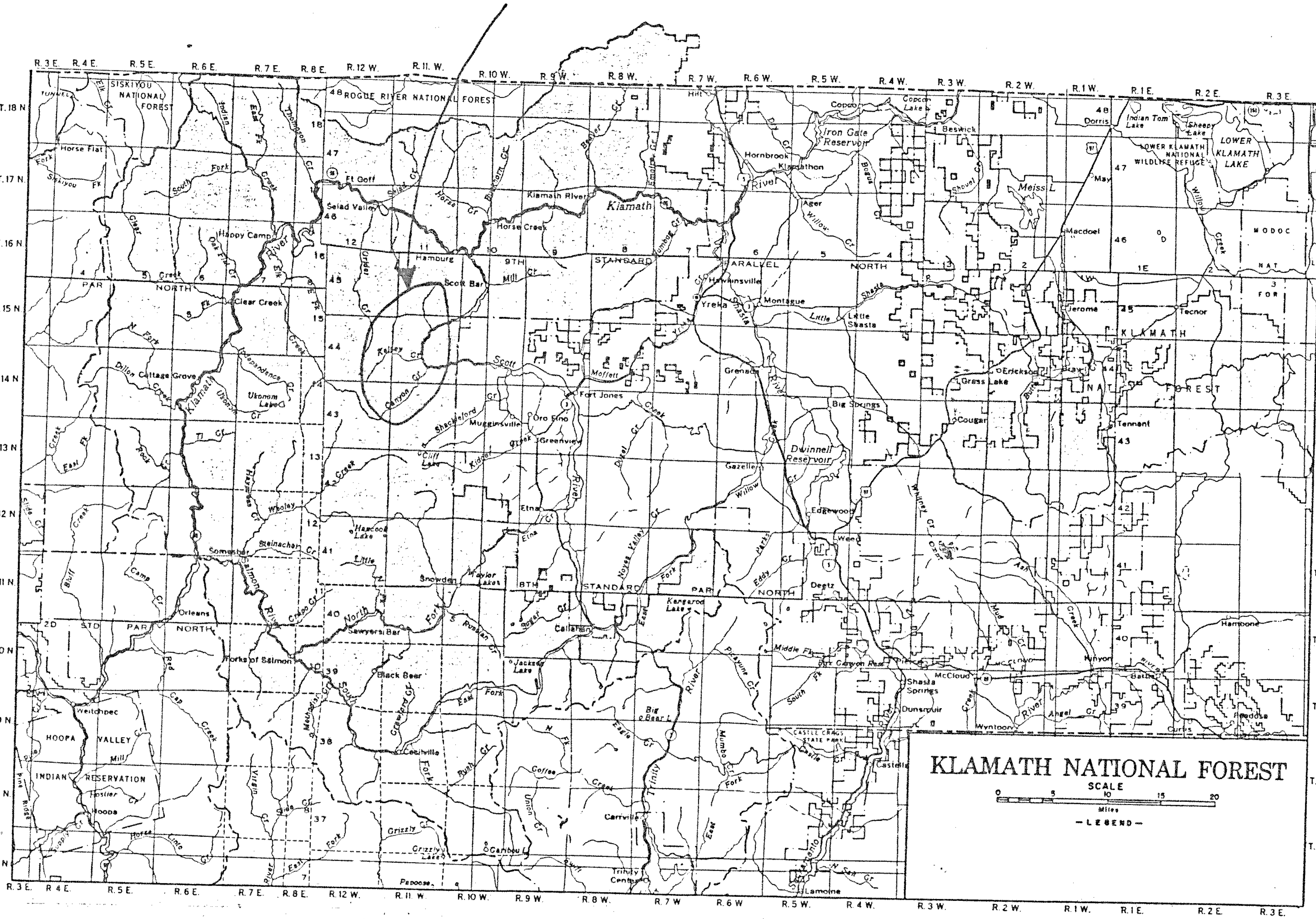


Figure 1. Project Location.

of redds and fish are made for "improved" reaches (stream reaches that have been treated by some instream restoration technique) and "control" reaches (stream reaches in an unaltered natural state). Water temperature, wetted channel width, length of survey, estimated stream flow, viewing and wading conditions, and redd and fish tallies wereentered in a "Rite in the rain" fieldbook following completion of each survey.

Field notes were transferred to a computerized database for storage and manipulation. Redd density (redds/square meter) and available habitat for control and improved stream reaches was calculated for each stream system monitored. Percent of run monitored was estimated based on viewing conditions and number of consecutive counts completed during the monitoring period. Estimated number of redds was calculated for each system by multiplying amount of available habitat by redd density then dividing that product by percent of run monitored.

Fall and winter-run steelhead females typically construct 1.3 redds each (Everest, personnal communication) and the average steelhead sex ratio is 1.5 males/female (Everest and Sedell, 1983), therefore 2.5 spawners are associated with every 1.3 redds, equaling 1.9 spawners per redd. Number of spawners was calculated by multiplying estimated number of redds by 1.9 fish/redd.

Results and Discussion

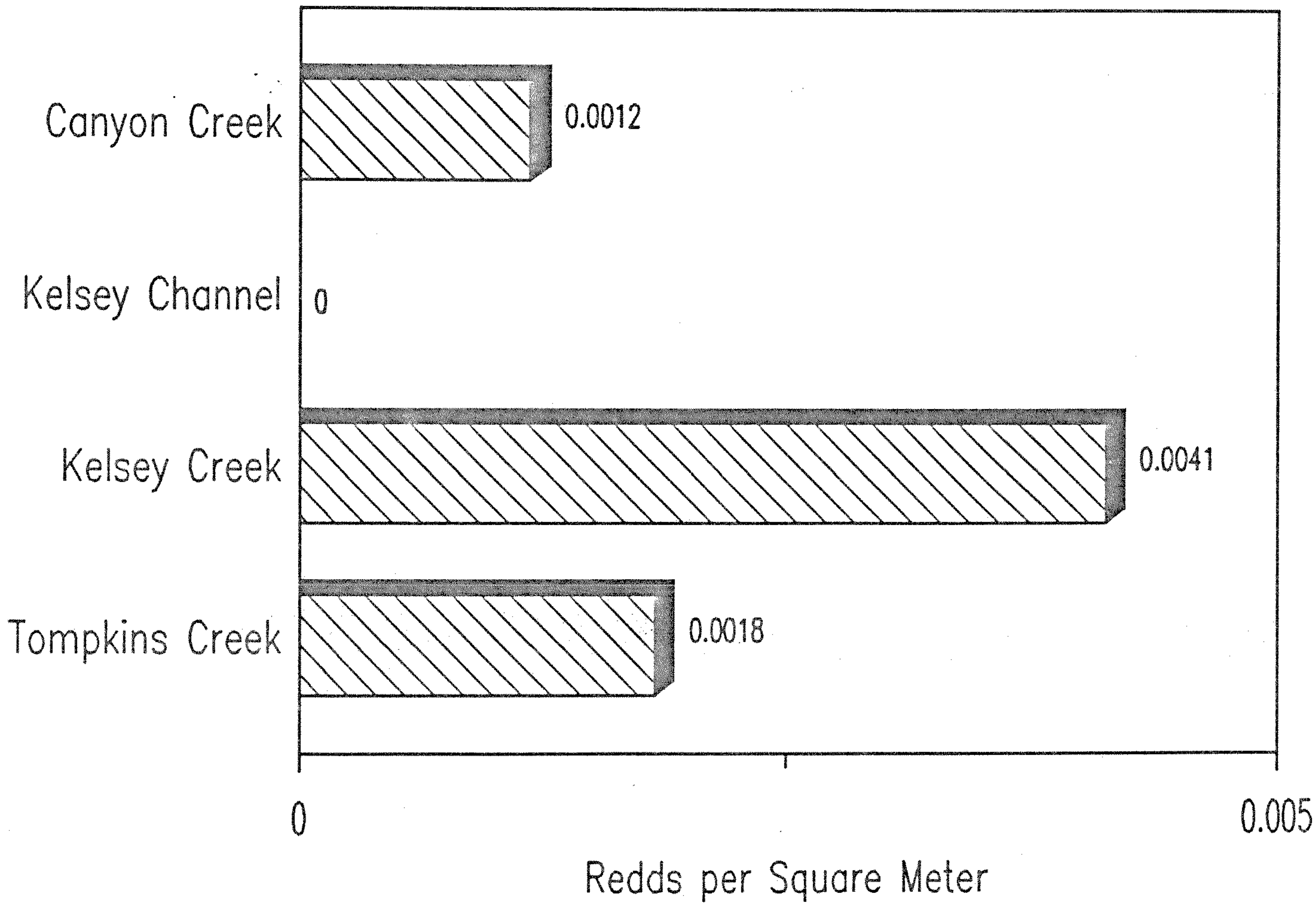
Relatively low discharge levels and lack of precipitation or snowmelt runoff resulted in excellent redd identification and wading conditions in 1988. Discharge and runoff conditions also allowed crews to complete inventories on an uninterrupted schedule, resulting in timely replicate counts which probably yielded improved accuracy of escapement estimates. Unfortunately low discharge levels also resulted in poor access to some habitats, particularly Tompkins Creek, and hence use was somewhat lower than previous seasons.

Redd densities in "control" stream reaches ranged from a low of .0012 redds/m^2 in Canyon Creek to a high of .0041 redds/m^2 in Kelsey Creek (Table 1). Redd density for the three monitored control reaches averaged .0024 redds/m^2 (Figure 2). Reaches enhanced by weirs on these streams recieved heavy usage compared to unenhanced reaches (Figure 3). Kelsey spawning channel recieved the highest use rate of any monitored "stream" reach, control or improved, .0582 redds/m^2. Total estimated escapement into Kelsey Creek, Kelsey channel, Tompkins Creek, and Canyon Creek in 1988 is 441 spawners.

Table 1. Estimated Steelhead Spawner Escapement in Scott River Index Streams, 1988.

Stream	Redds/M^2 Cntrl./Impvd.	Redd Count Cntrl/Impvd	Total Habitat Meter^2	Est. Run Redds/Fish
Canyon	0.0012/0.0062	21/9	26774	43/82
Kelsey	0.0041/0.0211	43/36	12144	88/167
Tompkins	0.0018/0.0109	28/8	25750	67/127
Kel.Chan	0.0000/0.0582	0/31	533	34/65

Scott River Control Reaches



A total of 65,171 m^2 of monitored habitat was available to steelhead spawners in 1988, which could produce about 3,259 smolts assuming $20m^2$ of suitable habitat is required to produce each smolt (Everest and Sedell, 1983). Habitat observations in 1987 indicated that each smolt in Kelsey Creek may require $11.4m^2$ of suitable rearing habitat, which would result in production of about 5,740 smolts from Tompkins, Kelsey, and Canyon Creeks assuming similar conditions are found in each system. If rearing habitat limits eventual adult escapement, projected adult escapement to this habitat would be roughly 287 fish from any brood year.

Hopelain (1982), found through scale analysis that maiden spawners in Scott River adult steelhead stocks comprise 65.0% of the escapement and repeat spawners comprise 35.0% of the escapement. Assuming those relationships are similar for these three systems, applying them to 1988 estimated escapement would infer that 287 of these fish would have been produced by the 1984 brood year, and 154 by previous years.

Rearing conditions can vary significantly between streams and between years because of variable quantities and qualities of habitat within each stream and differences in discharge, water temperature, and other productive features between years when juveniles are in freshwater. It is likely that juvenile rearing conditions are limiting eventual adult production in these streams and Scott River (Table 2).

Table 3. Relationship between spawning and rearing habitat for steelhead in 3 Scott River tributaries.

IF REARING SPACE IS NOT LIMITING PRODUCTION:

Est. steelhead redds (observed) 1984	= 215 redds
Est. # females @ 1.3 redds/female	= 165 females
Eggs from 178 females @ 2200 eggs/female	= 363,000 eggs
Emergent fry (30% emergence)	= 109,150 fry
Parr (20% survival fry-parr)	= 21,830 parr
Smolts (50% survival parr-smolt)	= 10,915 smolts
Adult return from brood year (5%)	= 546
Adult return from repeat spawners	= 294
Total expected adult return 1988	= 840

IF REARING SPACE IS LIMITING PRODUCTION:

Rearing area required per smolt (observed)	= 11.4 m^2
Rearing area in Kelsey, Canyon, Tompkins	= 65,171 m^2
Smolts accomodated	= 5,740 smolts
Adult return from any brood year (5%)	= 287
Adult return from repeat spawners	= 155
Total predicted adult return 1988	= 442
1988 Estimated adult return	= 441

It appears that the present spawning area can accomodate enough eggs to fully seed these three tributary systems. Obviously there are numerous assumptions associated with calculations in Table 2, and therefore those results should be viewed with those assumptions in mind and serve to identify gross trends in habitat productivity. Emphasis should be placed on furthur investigating egg incubation and rearing conditions.

Little is known about the importance of main channel rearing in either the Scott River or the Klamath and its estuary. It is likely that either or both these habitats serve some, possibly major, role in rearing juvenile steelhead. Mills (personnal communication) has indicated that juvenile steelhead outmigration occurs all year, but shows two peak periods, spring and fall. Bjornn (1978) found that outmigration from the Lemhi River in Idaho also occurred with two major peaks. He suggested that smolt outmigration dominated the spring seasonal movement and fall outmigrants were actually moving downstream in search of suitable winter rearing habitat. This could also be the case in upper Klamath River tributary systems.

In summary, the results of steelhead escapement monitoring indicate that average escapement levels into these three tributaries are adequate to seed present available habitat to rearing capacity from single brood-year returns and repeat spawners provide "insurance" in those years when poor year class escapement occurs from some anomoly either instream or in some other phase of the life cycle. More importantly, this analysis brings up a number of questions that need to be addressed: a) What is the actual summer and winter rearing capacity of these tributaries? b) What is the actual sex ratio of adult steelhead that escape to spawn? c) What role do river and estuarine habitats play in rearing juvenile steelhead to smolt? d) How many redds does the typical female steelhead construct? e) How might instream rearing habitat enhancement activities affect spawner escapement? f) Does the ratio of maiden to repeat spawners change annually, or is it related to gross environmental conditions?

Literature Cited

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