Hello chairman Milinsky and all of the board members my name is Mark Walker, I appreciate the time you have given me to give my testimony on the state of the Cook inlet Salmon fishery. I have lived in Alaska my whole life besides a few years for college. I have been a permit holder in the Cook Inlet drift gillnet fishery since 2013. Since the 2013 season we have seen a slow decline in the quality of fishing in cook inlet. There are a couple issues that I believe have been factors in the decline of the Kenai River late run sockeye fishery. One is catch and release fishing and pertains to proposal 116. And the other is the amount of traffic on the river whether it is foot traffic or boat traffic pertaining to proposal 164.

First I want to talk about catch and release and how it relates to proposal 116. I like to catch big kings and reds on rod and reel as much as anybody else. There is a point though when we need to start looking at the factors that are causing our beloved Kenai River to suffer. The fisherman should not be allowed to catch and release fish when run strengths are low. ADFG did a study in 1990 on the mortality rate of catch and release king salmon on the Kenai River. The study is FISHERY DATA SERIES NO. 90-16 by Terry Bendock and Marianna Alexandersdottir. In this study it was found that 10% of all fish caught and released died and did not spawn. If you think about this exponentially over time, that is a very large number of fish that have died from catch and release. There is a reason why the runs have diminished so much over the last 30 years. If a 1000 to 3000 fish don't make it to spawn every year in a fishery that is only 10000-25000 fish numbers are going to diminish.

Second thing that concerns me is the number of motorized boats that frequent the Kenai River above the Soldotna bridge which relates proposal 164. The number of boats on the river have a large effect on the fine sediment which is transported throughout the river. The fine sediment that is put in the water effects the salmon's ability to position their eggs in gravel beds for spawning. A study on Kenai river bank erosion by Kevin M Scott states "The effect erosion has on salmon habitat occurs mainly through deposition of fine sediment in the pores of the streambed gravel in reaches used for spawning and rearing." This is why motorized use should be suspended during spawning so that there is less sediment being transferred in the water so fish are able to spawn with optimal stream bed conditions. In proposal 164 the word "Downstream of the Soldotna bridge" Needs to be changed to "Upstream of the Soldotna bridge".

Again I want to thank you for your time and listening to my testimony.

http://www.adfg.alaska.gov/FedAidPDFs/fds90-16.pdf

https://pubs.usgs.gov/pp/1235/report.pdf

https://www.arlis.org/docs/vol2/jrmic/docs/usfs/USFS_PNW_RP_220.PDF

FISHERY DATA SERIES NO. 90-16

HOOK AND RELEASE MORTALITY OF CHINOOK SALMON IN THE KENAI RIVER RECREATIONAL FISHERY[1]

By

Terry Bendock
and
Marianna Alexandersdottir

Alaska Department of Fish and Game
Division of Sport Fish
Anchorage, Alaska

August 1990

[1] This information was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Project F-10-5, Job No. S-32-13.

Exposure to the Recreational Fishery

All of the chinook salmon used in this study were hooked and released at least once, and 22 of these fish (the sport harvested component) were angled at least twice. We confirmed additional hook and release events for 7 fish. One of these fish had tackle in its jaw from a previous event when we caught and tagged it, and the others were caught, released, and reported to us by recreational anglers. Three of these multiple recaptures survived to spawn, while one each of the remaining fish was a sport harvest, drop-out, set net, and tag net fate. A fish that was caught and radio-tagged on 27 July had been captured by gill net and spaghetti tagged on 12 July and was carrying sport tackle from an interim hooking event. This fish was judged to have survived and spawned in the lower Kenai River during mid August.

The Cook Inlet commercial set gill net fishery for salmon opened on 1 July. On 14 July, we tagged a chinook salmon that was scarred by a previous encounter with gill nets and subsequent to that date, 13 tagged salmon (21%) had similar gill net injuries.

Thus, prior to entering our study as hooked and released fish, many salmon experienced recent angling or netting events which may have influenced their ultimate fate. It was only possible to reconstruct fishery histories based on the most obvious and gross verification (tackle, scars, wounds) of those events.

Those fish that moved past the data logger at rkm 30.6 spent on the average 5-7 days in the lower reach, which was where 16, or 73%, of the 22 sport harvested fish were caught (Figure 13). However, 28% of the survivors spawned below rkm 33.8, which is in the major sport fishery area.

DISCUSSION

Hook and Release Mortality

The hook and release mortality rates estimated in this study were significantly smaller then the 20% tolerance level established at the beginning of the study (α=0.2). The hook and release mortality rate was estimated to be 13% (±6%) for males and 7% (±6%) for females, and an estimated 10% (±8%) in total suffered hook and release mortality, assuming the worst case scenario. This estimated worst-case rate of hook and release mortality for Kenai River chinook salmon is lower than mortality rates in sport fisheries reported for many other species (Mongillo 1984, Vincent-Lang et al. In Press, Warner and Johnson 1978). Wertheimer (1988) and Loftus et al (1988) reported mortality rates of 24.5% and 20.5% for sub-legal and legal length chinook salmon captured using commercial troll gear in salt water. These rates also exceeded our worst-case estimate.

In this study, the data were stratified by sex as the mortality rates were significantly higher for males than for females. No other variables were found to have a significant effect, but sample sizes were small. There were

Erosion and Sedimentation in the Kenai River, Alaska

GEOLOGICAL SURVEY PROFESSIONAL PAPER 1235

Prepared in cooperation with the U.S. Fish and Wildlife Service category of alterations to the navigable channel for which a permit from the Department of the Army is required. Upland development and land-use changes are not considered.

In a stream the size and type of the Kenai River, increased suspended-sediment transport will be the first general effect of development with the potential to be deleterious to the physical stream system, chiefly through deposition of fine sediment in the pores of the streambed gravel. Consequently, the present levels of suspended-sediment concentration and the possible causes of future increases are emphasized. Other changes in the sediment system are, of course, possible.

The most important feature of the environment to the economy of the area is the ability of the Kenai River to act as the freshwater habitat for salmon taken directly by sport fishing and indirectly by commercial fishing in Cook Inlet. Four species (king, sockeye, silver, and pink) use the river for spawning in runs from early spring to as late as December. The presence of chum salmon has also been reported. The young of three valuable species (king, sockeye, and silver) are found in the stream year round. Every nontidal part of the river is a known or potential spawning site for at least one species (U.S. Army Corps of Engineers, 1978, fig. 27).

Salmon-producing habitats are sensitive to many factors, but most importantly to sedimentation and water temperature (Meehan, 1974, p. 4). The deposition of fine sediment, with the consequent loss of permeability in streambed gravel during the time of egg and fry development, has been described by many studies as the most detrimental sedimentation effect (for example, Meehan and Swanston, 1977, p. 1). The deposited sediment reduces the flow of oxygen-bearing water within the gravel where eggs and alevins (preemergent fry) are incubating. It may also act as a physical barrier to the emergence of fry and may cause changes in the population of aquatic insects on which the young salmon depend for food.

Erosion and sedimentation have been described as the most insidious of civilization's effects on aquatic life, in that the processes may go unnoticed and the damage can be widespread, cumulative, and permanent (Cordone and Kelley, 1961, p. 189). Unlike most causes of degradation in water quality, erosion and the resulting increase in sediment transport may be triggered by a set of conditions and then may continue to increase or even accelerate after the triggering circumstances have ceased. The possible causes of such a response and why this form of response could occur along the sections of the Kenai River with high, presently stable cut banks are one focus of this report.

Acknowledgments.—This study was completed in cooperation with the U.S. Fish and Wildlife Service, to the personnel of which the writer is indebted for much helpful discussion and the supply of aerial photographs. Many local residents shared their knowledge of the past behavior of the Kenai River and helped form the writer's historical perspective on the stream.

THE KENAI RIVER WATERSHED

The Kenai River drains 2,200 mi^2 of the Kenai Peninsula, encompassing a watershed that extends from the icefields of the Kenai Mountains westward to Cook Inlet. Summer flow originating as melt water from ice- and snow-covered terrain dominates the hydrologic system of the river. Approximately 210 mi^2 of the drainage basin consists of glaciers or permanent snowfields, of which 130 mi^2 is part of the Harding Icefield and attached valley glaciers (fig. 1).

CLIMATE

The climate of the watershed is transitional between the wet and relatively mild marine climate of coastal areas and the colder and dryer continental environment of interior Alaska. The high sustained flow in the Kenai River in middle and late summer reflects the combination of melt water and superimposed storm runoff. More than half the annual precipitation falls in the 4-month period from July through October, with an average of almost 4 in. occurring in September, the wettest month.

Annual rainfall totals vary greatly within the drainage basin because of the orographic effect of the Kenai Mountains on storm systems moving northward from the Gulf of Alaska. In the lowlands downstream from Skilak Lake the annual precipitation is less than 20 in. Southeastward in the progressively higher parts of the basin, precipitation totals increase markedly and probably exceed 80 in. at the crest of the range. The regional distribution of precipitation is reflected in the altitudes to which glaciers descend—many outlet glaciers extend to the tidewater of the Gulf of Alaska; within the Kenai River drainage basin, however, valley glaciers reach no lower than 500 ft.

VEGETATION

The flood plain of the Kenai River and the surrounding terrain are covered by Alaskan taiga association of white spruce and hardwoods, locally with black spruce on north-facing slopes and poorly drained areas (Helmers and Cushwa, 1973, figs. 1, 2; U.S. Army Corps of Engineers, 1978, fig. 31). Evidence of stream behavior well as convenient parking. At a few sites large volumes of gravel have been displaced, most of which has been used for fill. At a few resorts developed on higher banks, large volumes of gravel apparently have been pushed into the channel and subsequently transported by the stream. In some cases the gravel ramps extending into the stream are periodically maintained with newly excavated gravel. The impacts of these commercial developments, whether they involve extending or cutting the natural bank, will correspond to those previously discussed for groins, boat ramps, and slips.

CONCLUSIONS

Suspended-sediment concentrations in the Kenai River are naturally low because of sediment retention in upstream lakes; levels known from other streams to be harmful to salmon habitat are reached only rarely. More frequent elevated concentrations may result from increase in development of the types now present along the navigable channel of the river. These types of development are listed in the preceding section in the order of their magnitude of impact on the sediment system of the stream.

Rates of bank erosion since 1950-51 show that sections of the river differ greatly in their sensitivity to development, as indicated in table 5. Throughout the central section of the river (between river miles 39.4 and 17.6) the channel is entrenched, partly armored, and has undergone rates of bank erosion that are very low to undetectable. Upstream and downstream from this section the bank erosion rates are more typical of proglacial streams—as high as 5 ft per year. Two additional sections of channel are exceptions to this pattern: the initial 3.8 river miles of channel below Skilak Lake are highly stable because of the presence of large gravel dunes emplaced by a pre-1950 flood surge; also, the downstream 9.0 river miles of channel are moderately stable because of the dominance of the tidal regime.

Development along the navigable channel will affect the sediment system of the stream in several ways. Construction may increase suspended-sediment concentration temporarily, with the greatest potential for harmful impact between January and May, as indicated by the relation between discharge and concentration for that period. Development can increase bank erosion, and thus the suspended-sediment concentration, over the longer term by causing cutoff of meander loops, loss of stabilizing vegetation on banks, and loss of the cohesive surface layer of flood-plain sediment.

Throughout this report, emphasis has been placed on the potential for increased suspended-sediment transport because that is the first general effect of development which is likely to be harmful to the physical stream system. The effect on salmon habitat occurs mainly through deposition of fine sediment in the pores of the streambed gravel in reaches used for spawning and rearing. There is additional concern for habitat conditions throughout the entrenched and partly armored section of channel. Without the cleansing action of flood flows competent to mobilize the coarser bed material of those reaches, increased transport of fine sediment will result in deleterious rates of deposition within the bed. In contrast with normal reaches, flow magnitudes competent to move the bed material of the armored reaches are greatly in excess of bankfull discharge and may not recur at the frequencies necessary to maintain a viable fishery if suspended-sediment transport increases.

Bank-erosion rates have been generally constant since 1950-51. The high cut banks present in entrenched and partially entrenched sections of channel have been mainly vegetated and stable through the same period. Loss of stability of the high banks is of special concern because of the potential for large, long-term contributions to the sediment load of the river. Ground photography in 1979 suggests that the high banks have locally begun to erode more rapidly, although verification of this possibility must await future study. A likely contributing cause of such erosion is increased intensity of river use and a recent change in sport-fishing technique.

The Kenai River salmon fishery is a major component of the economic base of the Kenai Peninsula. It justifies continued concern for changes in the sediment system of the stream, in response to channel and flood-plain development as well as trends in land use and other changes within the watershed. This can be best accomplished by monitoring the suspended-sediment concentration and the stability of the high banks.

REFERENCES CITED

Anderson, G. S., and Jones, S. H., 1972, Water resources of the Kenai-Soldotna area, Alaska: U.S. Geological Survey Open-File Report, 81 p.

Baker, V. R., and Ritter, D. F., 1975, Competence of rivers to transport coarse bedload material: Geological Society of America Bulletin, v. 86, p. 975-978.

Brice, J. C., 1964, Channel patterns and terraces of the Loup Rivers in Nebraska: U.S. Geological Survey Professional Paper 422-D, p. D1-D41.

—— 1973, Meandering pattern of the White River in Indiana—an analysis, *in* Morisawa, Marie, ed., Fluvial geomorphology: Binghampton, State University of New York, p. 179-200.

—— 1980, Stability of relocated stream channels: Federal Highway Administration Report FHWA/RD-80/158, 177 p.

Brice, J. C., and Blodgett, J. C., 1978, Countermeasures for hydraulic problems at bridges; volume 1, Analysis and assessment: Federal Highway Administration Report FHWA-RD-78-162, 169 p.

1977
USDA Forest Service Research Paper PNW-220

EFFECTS OF GRAVEL MORPHOLOGY ON FINE SEDIMENT ACCUMULATION AND SURVIVAL OF INCUBATING SALMON EGGS

WILLIAM R. MEEHAN
DOUGLAS N. SWANSTON

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE
PORTLAND, OREGON

METHODS

Two separate experiments were conducted; one to evaluate the short term accumulation of fine sediment under different waterflow conditions as affected by gravel shape and the second to relate gravel shape to long term fine sediment accumulation and to survival of incubating salmon embryos.

Short Term Fine Sediment Accumulation

Gravels varying from 2.54 to 10.16 cm in diameter were hand picked and separated into *angular* and *round* classes. The gravel came from a presently dry portion of the channel of East Creek. The selected dry gravels were placed in number 10 cans, weighed, and then buried just below the "gravel pavement" layer in the experimental stream channel. Water was then conducted into the channel and flows brought to designated levels until a steady flow was reached. In 1971, four experimental runs were made at flow rates of 0.65 m^3/s, 0.41 m^3/s, 0.235 m^3/s, and 0.145 m^3/s. Two additional runs were made in 1973 at 0.80 m^3/s and 0.57 m^3/s. Experimental procedure was as follows:

a) Flow rate to be sampled was allowed to stabilize in the test section and was allowed to run until erosion armor formed and observable bed-load transport ceased.

b) The flow was then stopped and 10 sample cans, 5 with angular gravel and 5 with round gravel, were buried in the test section with the can mouths below the armor and the gravel flush at the surface of the channel (fig. 5).

Approximately 104 kg of fine sediment <2.0 mm (in the short

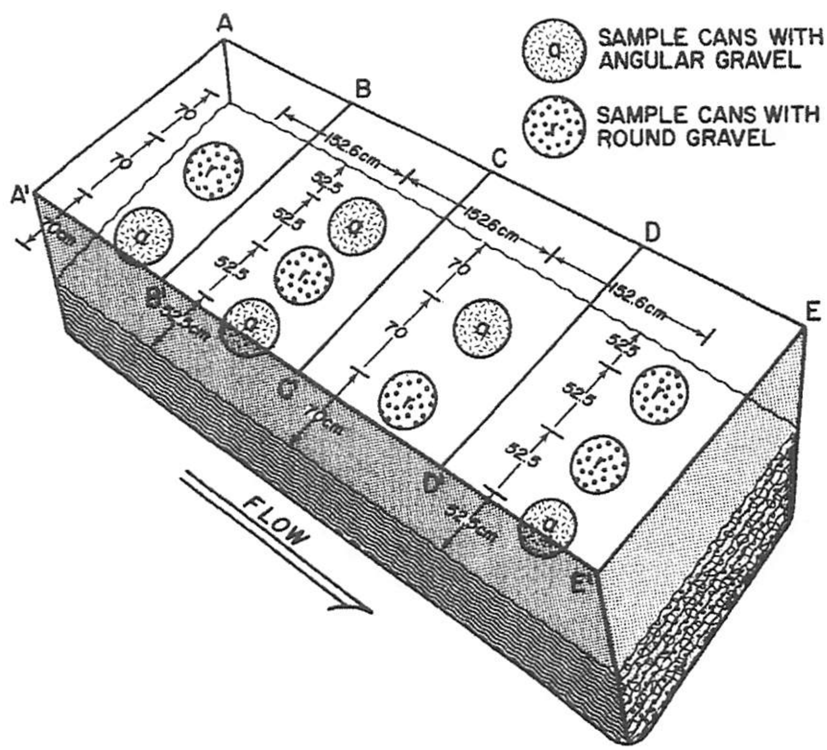

Figure 5.--Diagram of test section showing dimensions and location of sediment sample cans.

term experiments, fine sediment is less than 2.0 mm) were then added at the weir entrance, and the steady rate of flow maintained for 3 hours. The gravel-filled cans were then removed, oven-dried, and weighed to determine the amount of added sediment which accumulated during the duration of flow. Preliminary tests indicated that if these experiments were run at decreasing discharge rates, the "erosion pavement" or "rock armor" developed on the gravel surface was adequate to preclude fine sediment transport in the channel and into the cans prior to addition of the finer sediment. Disturbance resulting from burial of the sample cans was kept to a minimum and is not believed to have appreciably affected the sediment measurements.

Long Term Fine Sediment Accumulation and Salmon Egg Survival

Ten stainless steel-mesh cylinders, each 45.7 cm deep and 30.5 cm in diameter were fabricated to serve as artificial "redds" (fig. 6).

Three gravel types were used in this portion of the study:

1) Round, stream-washed gravel 2.54 to 10.16 cm in diameter, composed primarily of argillit and greenstone.
2) Broken angular gravel, 2.54 tc 10.16 cm in diameter, composed mainly of quartzite.
3) Natural gravel from East Creek which was made up of the above types and which was somewhat platy in form.

The round and angular gravels were the same type as those used in the short term fine sediment accumulation tests (in the long term experiments, fine sediment is less than 0.833 mm).

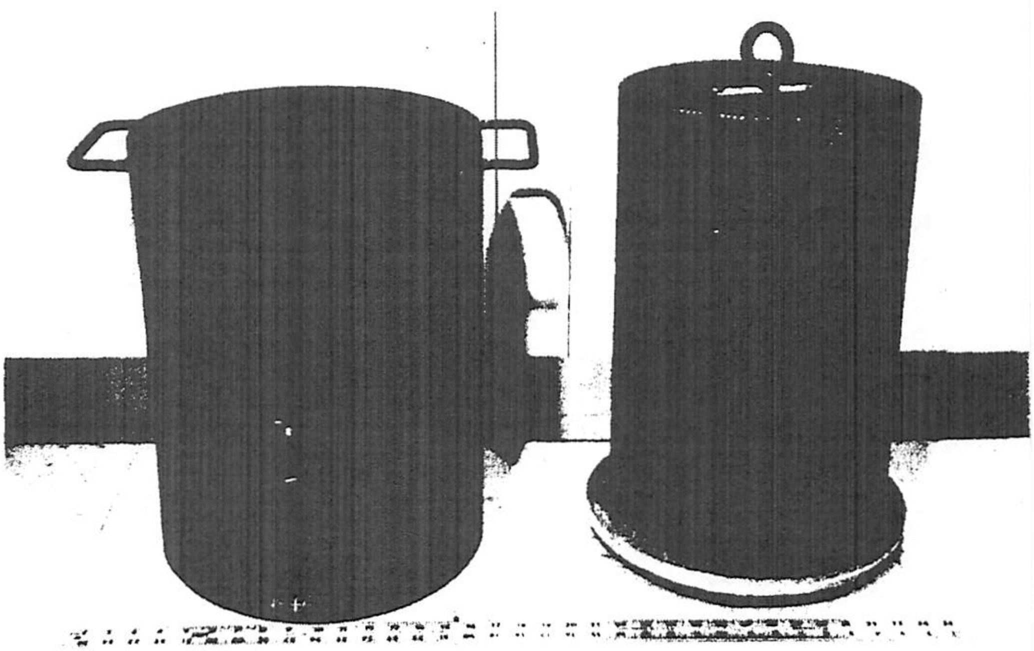

Figure 6.--Basket used as artificial "redd" and outer casing for retaining sediment when basket was removed from streambed.