A workshop series to build capacity for collaborative fisheries co-management among Copper River Native Groups

by

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Final Report Summary Page

Title: A workshop series to build capacity for collaborative fisheries co-management among Copper River Native Groups.

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Information type: Fisheries management capacity building for native communities.

Issues Addressed:
1. Management and stock assessment methods used to manage the Copper River salmon fisheries.
2. Understanding and developing the collaborative foundations needed for intertribal fisheries organizations in the Copper River drainage.

Key Words: Salmon, co-management, subsistence, fishery management, stock assessment, fishery monitoring, fishery techniques, Copper River, southcentral Alaska.

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Abstract

Two workshops were conducted as part of a project to increase understanding of salmon management techniques and co-management potential in the Copper River. The workshops were open to the public, with the target participants being subsistence representatives from the upper Copper River. The first workshop consisted of a two-day seminar to describe stock assessment and management techniques currently used to manage key salmon fisheries on the Copper River. The second workshop consisted of a three-day trip to Cordova by upper river representatives to examine field applications of stock assessment and management techniques discussed in the first workshop. This workshop was built around the Miles Lake sonar site. A third meeting that was to have been a two-day seminar to examine the structure of native fish commissions elsewhere in North America and discuss the potential for fishery co-management in the Copper River was canceled for a number of reasons, including staff turnover within CRNA.

Introduction

The Copper River, Alaska, has annual returns of millions of salmon that support subsistence, sport, and commercial fisheries. These fisheries are managed by the Alaska Department of Fish and Game, which employs numerous management and stock assessment techniques in an attempt to provide satisfactory salmon returns to the multiple stakeholders in the Copper River drainage. One prominent stakeholder group is the Copper River Native Association, which relies on subsistence use of salmon returning to the upper Copper River. Although the CRNA is heavily dependent upon subsistence use, an historic lack of exposure to techniques used to manage the Copper River fishery has left CRNA members with relatively little input into management of the fishery that has traditionally sustained them. A long-term goal of the CRNA is to develop an inter-tribal fisheries commission, similar to those found on other rivers, capable of providing a venue for local tribal organizations to participate in the management of the subsistence fishery.

Two multi-day workshops were held in 2002 to increase the understanding of fisheries management issues and practices, and thereby build capacity for CRNA to meaningfully participate in the assessment and management of the Copper River fishery. The workshops were designed to unfold sequentially; the first workshop provided an overview of biology, management, and assessment techniques of the Copper River salmon fisheries. The second workshop consisted of a multi-day site visit to Cordova to examine field applications of stock assessment and management techniques discussed in the first workshop. Both workshops were open to all interested people and were advertised in CRNA member villages. The specific objectives of the project were to:

1. Provide discussion and training on stock assessment and techniques used to manage Copper River salmon fisheries.
2. Visit representative stock assessment projects on the Copper River to get hands-on familiarity with techniques discussed in Objective 1.

Methods and results

Workshop 1

Workshop 1 was conducted on April 11 and 12, 2002, at the tribal hall of the Native Village of Tazlina. The workshop was split into four modules over the two days from April 11 to April 12, 2002 (Appendix A). Each module was an oral presentation led by Matt Nemeth and supported by overheads and a map of the Copper River drainage. Bill Simeone, Alaska Department of Fish and Game and Dave Nelson, National Park Service, gave presentations in module 2, on the afternoon of April 12. Copies of overheads and various supporting pages were provided in workshop packets distributed in advance to subsistence representatives (Appendices B-E). Overviews and handouts were taken from primary research, management reports, web sites, and original drawings.

The first module consisted of an overview of the biology and life history of rainbow and steelhead trout, and chinook, sockeye, and coho salmon (Appendix B). This began with a description of the Copper River environment and emphasized how the drainage size, turbidity, and water temperature influenced fish biology and life history, and thereby contribute to life history differences among and within species. The differences in ages, run timing, and stream residency was underscored. The European method for age classification – in which age 2.3 reflects a five-year-old fish that had spent two years in freshwater and three years in saltwater - was introduced and discussed.

After reviewing the basic biology and life history of the selected fish species, the module continued with a detailed look at key life stages of the fish. These stages were return spawning, egg incubation and hatching, juvenile emigration, and ocean life. Key features (e.g., size at age for juvenile emigrants), primary sources of mortality, and the current state of knowledge was presented for each stage. The concept of the thermal unit (TU) requirements was introduced and defined as 24 hours spent at one degree above 32° F. The relevance of TU requirements to migration timing and spawning location was then discussed.

The second module consisted of an overview of the three Copper River fisheries, with guest presentations on the subsistence fishery (Appendix C). The overview of the fisheries included descriptions of the seasons, species, locations, and gear relevant to the subsistence, sport, and commercial fisheries. Tom Taube's presence was an especially helpful addition to the module, as he provided considerable insight while engaging in numerous discussions with different participants. As requested by CRNA, much of the presentation emphasized the subsistence fishery regulations and a description of the commercial fishery gear types and harvests.

The presentation by Bill Simeone explored the potential contributions of customary and traditional knowledge to fisheries management, both in general and on the Copper River. Mr. Simeone described information gathered during his TEK projects in the local area and reported a recent conference, held in British Columbia, that was devoted to the subject. The presentation sparked a great deal of discussion. A large part of this discussion focused on using the knowledge of Elders to identify and prioritize future research needs. Examples of this included the ability of TEK to identify changes in fish

run timing, alterations in population location and abundance, and environmental changes such as water table height.

The presentation by Dave Nelson gave a thorough overview of the current subsistence regulations, including recent changes and new proposals. Mr. Nelson's presentation was particularly timely because of recent changes in the permitting process and because of the significance of several 2003 proposals to the Federal Subsistence Board. In addition to recent and proposed changes, the presentation emphasized the permitting process, harvest levels, and great types.

The third module was an overview of the methods most frequently used to estimate escapement and to monitor populations of Copper River fish (Appendix D). Sonar counts, mark-recapture population estimates, weir counts, and aerial surveys were all discussed in greater detail. The intended uses, strengths, and weaknesses of each technique were described. Specific examples of each technique included the Miles Lake site for sonar , ADF&G chinook salmon radio telemetry and Native Village of Eyak fishwheels for mark-recapture, Tanada Creek escapement monitoring for weirs, and Prince William Sound escapement indices for aerial surveys. A mark-recapture classroom exercise was conducted with small and large goldfish crackers to illustrate how the technique generates population estimates and ranges. The differences between population estimates and indices were emphasized. The module generated considerable discussion and questions on the details of specific Copper River stock assessment projects.

The fourth module described the results of assessment projects and the information about the fish resource that they have provided (Appendix E). There was then considerable discussion about the potential roles of Native groups in the types of projects discussed in the escapement and monitoring module. The workshop then concluded with a discussion of the next two workshops and the potential assessment projects to visit as part of Workshop 2.

The workshop was open to all interested people (Appendix F). Gloria Stickwan advertised the workshop in Tribal media and recruited representatives from Cantwell, Gakona, Gulkana, Kluti-Kaah, and Tazlina. These representatives were compensated for travel and time as part of the grant. Matt Nemeth recruited biologists, project managers, and fishery managers working in the upper Copper River.

Workshop 2

Subsistence representatives visited Cordova from July 31 to August 2 to view specific projects discussed in Workshop 1 and to learn about aspects and issues in the lower Copper River that affect subsistence fisheries in the upper Copper River. The primary purpose was a site visit and presentation at the Miles Lake sonar station, but several other presentations were also given by regional organizations (Appendix G). These presentations and site visits are summarized as follows:

- CRNA representatives traveled to Mile Lake on July 31 and spent 3 hours at the site. Jane Browning and Don Malherek, ADF&G staff, each gave a presentation

on the use, history, and future of the station, and explained how the station affected inseason and postseason management of the fishery. Matt Nemeth described how the sonar system could be used in conjunction with other stock assessment projects in the future. The presentation was supplemented with handout materials from Workshop 1 (Appendix D).

- CRNA representatives met with staff from the Native Village of Eyak on July 31 to learn about the chinook escapement monitoring project operating on the Copper River at Baird Canyon. NVE staff also briefed CRNA on other NVE projects such as the Lower River Test Fishery and the Partners in Fisheries Monitoring.
- CRNA representatives were given a tour of the Prince William Sound Science Center (PWSCC) on August 1, then met with Nancy Bird, Richard Thorne, and Gary Thomas. The meeting lasted for 1.5 hrs, during which PWSSC scientists described their ongoing work and ways in which it related to issues in the upper Copper River. The potential for and importance of studies of juvenile salmon production in Copper River lakes was discussed in detail, and Dr. Thomas described ways in which sonar could potentially be used for such studies.
- NVE staff took CRNA subsistence representatives to visit the fishwheel sites above Miles L on August 2, then flew the representatives to Valdez for their return to the upper Copper River.

Workshop 3

Workshop 3 was postponed several times and finally scheduled for November, but was canceled when Ms. Stickwan left CRNA and her position went unfilled.

Conclusion and recommendations

Workshops 1 and 2 were attended by a small but active group of subsistence representatives from within the target region. Much of the workshop content was information that representatives had been exposed to in passing but had never heard fully explained. Several participants expressed that such a workshop could be valuable on an annual basis and would increase participation residents in fishery-related meetings. Workshops topics that subsistence representatives specifically identified as useful in post-workshop discussions and evaluations included:

- How the federal and state governments coordinate fishery management in the Copper River.
- Life history aspects of Copper River salmon such as juvenile ecology, age structure, genetic traits, and how the River influences salmon life histories.
- How salmon ages are determined and why fish age is important to management.
- Why salmon are tagged and why the potential intrusion into the fish run may be justified.
- How basic population estimates are conducted and why they are variable.
- How sonar is conducted and used in management.
- The description of gear types used in the commercial fishery and how the commercial fishery is managed.

- How management of the commercial and subsistence fisheries is coordinated.
- Examples of co-management fisheries projects currently conducted by tribal organizations in Alaska.
- Potential sources of funding for future co-management projects.

This was the first visit to Cordova by at least three of the participants, and the first visit to a sonar stations by all subsistence representatives. In addition to meeting the Miles Lake objective, participants learned a great deal about relevant science in the area and had substantial exposure to a Tribal organization (NVE) and their co-management projects. One of the participants, Johnny Goodlataw, was subsequently contracted to assist with the construction of a fishwheel operated by NVE downstream of Chitina.

The cancellation of the final workshop costs participants the opportunity to fully synthesize topics from prior workshops and to explore the potential for co-management in the upper Copper River. While regrettable, this workshop may have also been overly ambitious given what turned out to be a low number of representatives attending the first two workshops. Such a workshop would clearly be valuable, but may need to come after a larger number of people have participated in topics covered in Workshops 1 and 2. The loss of this workshop may have also been partially offset by the covering a greater amount of ground than expected in the first two workshops.

If such a projected is conducted in the future, specific recommendations include:

- Advertise the workshops at key Tribal meetings well in advance.
- Retain both the biology and management modules contained in Workshop 1.
- Highlight specific examples of co-management projects currently conducted elsewhere in Alaska.
- Include leaders of regional or Tribal organizations as guest lecturers.
- Direct the project with co-chairs from within the region to achieve greater spatial and organizational coverage.

Acknowledgements

Numerous people assisted with the presentations, source material, and curriculum ideas for this project. Of particular help for Workshop 1 were Tom Taube, Bill Simeone, and Dave Sarafin (ADF&G) and Dave Nelson and Eric Veach (NPS). Of particular help with Workshop 2 were Dan Gray, Jane Browning and Don Malherek (ADF&G), Nancy Bird, Richard Thorne, and Gary Thomas (PWSSC), Mike Lambert, Iris O'Brien, and Bruce Cain (NVE), Sue Aspelund (Cordova District Fishermen United), and the staff of Ocean Beauty Seafoods in Cordova). The U.S. Fish and Wildlife Service, Office of Subsistence Management provided the funding for this project.

Appendix A - Agenda for Copper River fisheries management workshop, April 11-12, 2002 in Tazlina, Alaska

Appendix A –

Agenda for Copper River fisheries management workshop, April 11-12, 2002 in Tazlina, Alaska

Hosted by Copper River Native Association
Funded by U.S. Fish and Wildlife Service – Office of Subsistence Management

AGENDA

April 11

1. 10:00 – 10:15. Introduction and workshop overview
    a. Participants
    b. Topics to cover

2. 10:15 – 11:30. Which fish? –The biology of Copper River salmon & trout
    a. Rainbow trout
    b. Steelhead
    c. Chinook/king salmon
    d. Coho/silver salmon
    e. Sockeye/red salmon

3. 11:30 – 12:30. Lunch

4. 12:30 – 2:00. Copper River fisheries and harvests – seasons, target species, locations, and gear
    a. Commercial fisheries
    b. Subsistence fisheries
    c. Sport fisheries

5. 2:00 – 2:10. Break

6. 2:10 – 2:50. Presentation by Bill Simeone, ADF&G. Contribution of customary and traditional knowledge to fisheries management

7. 2:50 – 3:00. Break

8.
9. 3:00 – 3:45. Presentation by National Park Service (Eric Veach or Dave Nelson). Fisheries management on federal lands in the Copper River drainage

10. 3:45 – 4:00. Day 1 conclusion

April 12

1. 10:00 – 10:15. Introduction and review of April 11

2. 10:15 – 12:00. How many fish? An introduction to escapement estimation and monitoring techniques
    a. What is escapement estimation?
    b. Estimating vs. Indexing
    c. Techniques
        i. Sonar
            1. How it works
            2. Description of Miles Lake sonar
        ii. The mark-recapture technique
            1. How they work
            2. Description of Baird Canyon fishwheels / king salmon project
            3. Description of upper Copper River fishwheels / steelhead project
        iii. Weirs
            1. How they work
            2. Description of weir sites in upper Copper River
        iv. Aerial surveys (indexing)
            1. How they work
            2. When and where they are conducted

3. 12:00 – 1:00. Lunch

4. 1:00 – 2:00. The importance of stock assessment projects
    a. What is stock assessment?
    b. Collecting biological information
    c. What can be done with the information?

5. 2:00 – 2:10. Break

6. 2:10 – 3:00. Review of projects in the Copper River

7. 3:00 – 3:10. Break

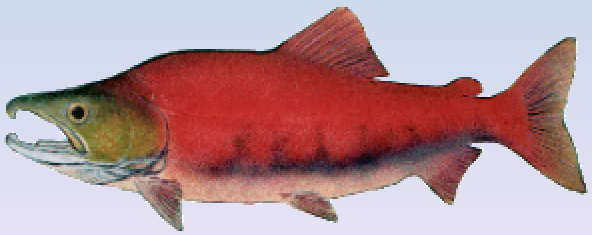
8. 3:10 –4:00. Discussion and wrap-up
    a. Potential sites to visit for Workshop 2
    b. Potential for subsistence-related projects in Copper River drainage
    c. Acknowledgements

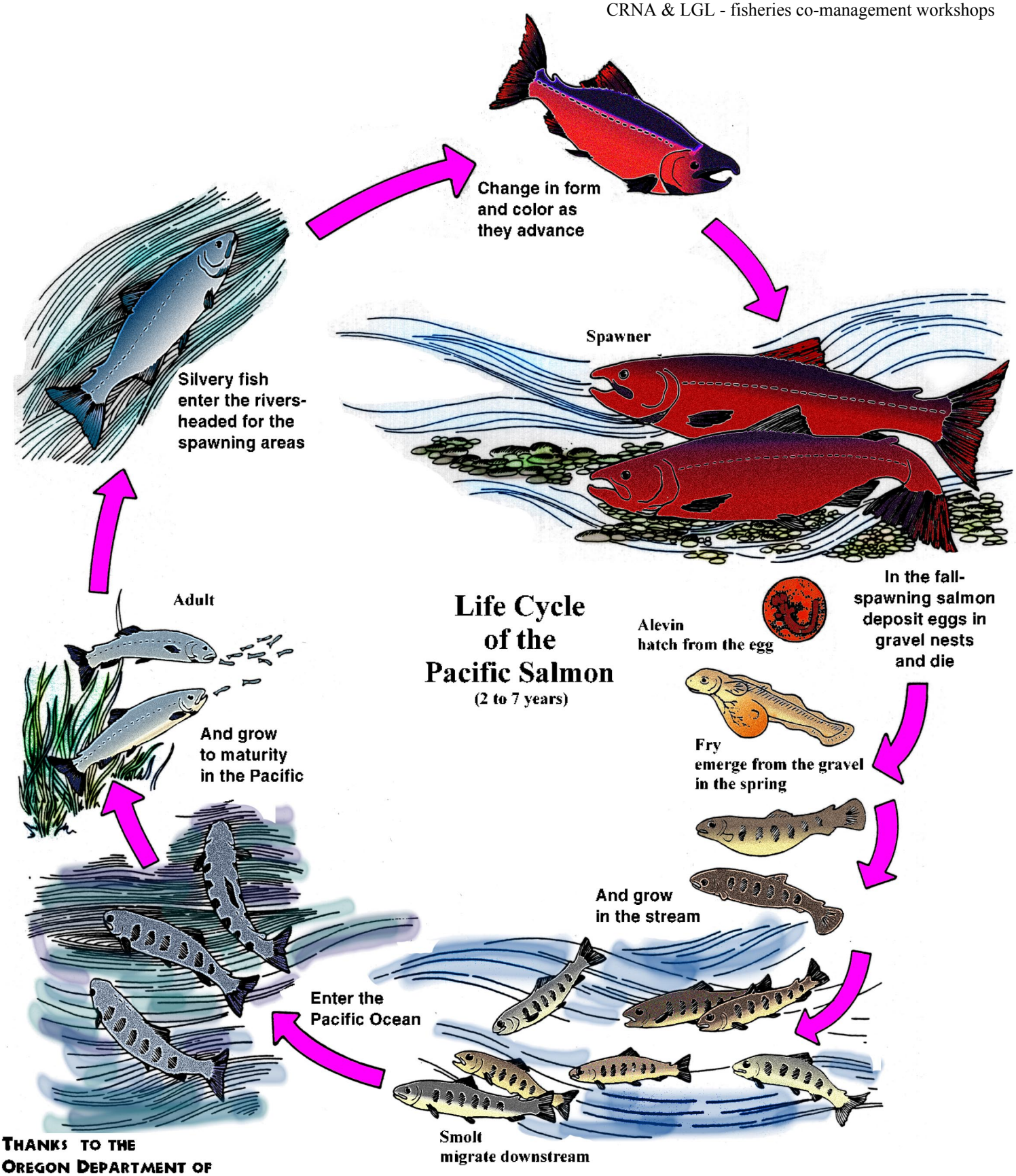
Appendix B - Visuals for Module I, Biology of Copper River salmon and trout

Map of Copper River drainage from Gulf of Alaska to headwaters.

Anadromous and Resident life histories

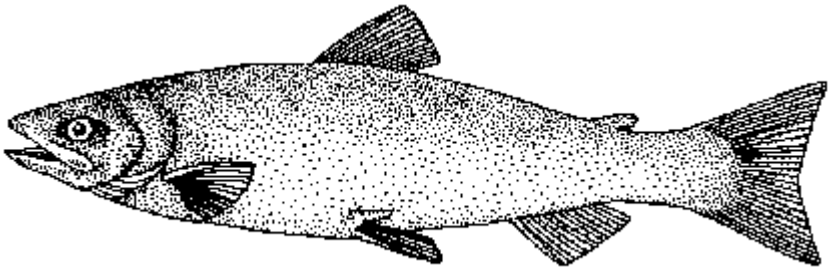
Anadromous		Age						
		0	1	2	3	4	5	
Stream	Hatching						Spawning	
Ocean								
Resident		Age						
		0	1	2	3	4	5	
Stream	Hatching						Spawning	
Lake								





THANKS TO THE OREGON DEPARTMENT OF FISH AND WILDLIFE "STREAM SCENE" CURRICULUM

Sockeye Salmon



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The **sockeye salmon** (*Oncorhynchus nerka*), often referred to as "red" or "blueback" salmon, occurs in the North Pacific and Arctic oceans and associated freshwater systems. This species ranges south as far as the Klamath River in California and northern Hokkaido in Japan, to as far north as far as Bathurst Inlet in the Canadian Arctic and the Anadyr River in Siberia. Aboriginal people considered sockeye salmon to be an important food source and either ate them fresh or dried them for winter use. Today sockeye salmon support one of the most important commercial fisheries on the Pacific coast of North America, are increasingly sought after in recreational fisheries, and remain an important mainstay of many subsistence users.

General description: Sockeye salmon can be distinguished from chinook, coho, and pink salmon by the lack of large, black spots and from chum salmon by the number and shape of gill rakers on the first gill arch. Sockeye salmon have 28 to 40 long, slender, rough or serrated closely set rakers on the first arch. Chum salmon have 19 to 26 short, stout, smooth rakers.

Immature and prespawning sockeye salmon are elongate, fusiform, and somewhat laterally compressed. They are metallic green blue on the back and top of the head, iridescent silver on the sides, and white or silvery on the belly. Some fine black speckling may occur on the back, but large spots are absent. Juveniles, while in fresh water, have the same general coloration as immature sockeye salmon in the ocean, but are less iridescent. Juveniles also have dark, oval parr marks on their sides. These parr marks are short-less than the diameter of the eye-and rarely extend below the lateral line.

Breeding males develop a humped back and elongated, hooked jaws filled with sharp caniniform teeth. Both sexes turn brilliant to dark red on the back and sides, pale to olive-green on the head and upper jaw, and white on the lower jaw.

Life history: Sockeye salmon are anadromous: they live in the sea and enter freshwater systems to spawn. After hatching, juvenile sockeye salmon may spend up to four years in fresh water before migrating to sea as silvery smolt weighing only a few ounces. They grow quickly in the sea, usually reaching a size of 4 to 8 pounds after one to four years. Mature sockeye salmon travel thousands of miles from ocean feeding areas to spawn in the same freshwater system where they were born. Little is known about the navigation mechanisms or cues they use on the high seas, although some evidence suggests that they may be able to use cues from the earth's magnetic field. Once near their natal freshwater system, sockeye salmon use olfactory cues to guide them home. Like all Pacific salmon, sockeye salmon die within a few weeks after spawning.

Maturing sockeye salmon return to freshwater systems from the ocean during the summer months, and most populations show little variation in their arrival time on the spawning grounds from year to year. Freshwater systems with lakes produce the greatest number of sockeye salmon. Spawning usually occurs in rivers, streams, and upwelling areas along lake beaches. The female selects the spawning site, digs a nest (redd) with her tail, and deposits eggs in the downstream portion of the redd as one or more males swim beside her and fertilize the eggs as they are extruded. After each spawning act, the female covers the eggs by dislodging gravel at the upstream end of the redd with her tail. A female usually deposits about five batches of eggs in a redd. Depending upon her size, a female produces from 2,000 to 4,500 eggs.

Eggs hatch during the winter, and the young sac-fry, or alevins, remain in the gravel, living off the material stored in their yolk sacs, until early spring. At this time they emerge from the gravel as fry and move into rearing areas. In systems with lakes, juveniles usually spend one to three years in fresh water before migrating to the ocean in the spring as smolts. However, in systems without lakes, many juveniles migrate to the ocean soon after emerging from the gravel.

Sockeye salmon return to their natal stream to spawn after spending one to four years in the ocean. Mature sockeye salmon that have spent only one year in the ocean are called jacks and are, almost without exception, males. Once in the ocean, sockeye salmon grow quickly. While returning adults usually weigh between 4 and 8 pounds, weights in excess of 15 pounds have been reported.

In some areas, populations of sockeye salmon remain in fresh water all their lives. This landlocked form of sockeye salmon, called "kokanee," reaches a much smaller maximum size than the anadromous form and rarely grows to be over 14 inches long.

Food habits: While in fresh water, juvenile sockeye salmon feed mainly upon zooplankton (such as ostracods, cladocerans, and copepods), benthic amphipods, and insects. In the ocean, sockeye salmon continue to feed upon zooplankton (such as copepods, euphausids, ostracods, and crustacean larvae), but also prey upon larval and small adult fishes (such as sand lance), and occasionally squid.

Fisheries: The largest harvest of sockeye salmon in the world occurs in the Bristol Bay area of southwestern Alaska where 10 million to more than 30 million sockeye salmon may be caught each year during a short, intensive fishery lasting only a few weeks. Relatively large harvests of 1 million to 6 million sockeye salmon are also taken in Cook Inlet, Prince William Sound, and Chignik Lagoon. All commercial Pacific salmon fisheries in Alaska are under a limited entry system which restricts the number of vessels allowed to participate. Most sockeye salmon are harvested with gillnets either drifted from a vessel or set with one end on the shore, some are captured with purse seines, and a relatively small number are caught with troll gear in the southeastern portion of the state.

Sockeye salmon are the preferred species for canning due to the rich orange-red color of their flesh. Today, however, more than half of the sockeye salmon catch is sold frozen rather than canned. Canned sockeye salmon is marketed primarily in the United Kingdom and the United States while most frozen sockeye salmon is purchased by Japan. Sockeye salmon roe is also valuable. It is salted and marketed in Japan.

There is also a growing sport fishery for sockeye salmon throughout the state. Probably the best known sport fishery with the greatest participation occurs during the return of sockeye salmon to the Russian River on the Kenai Peninsula. Other popular areas include the Kasilof River on the Kenai Peninsula as well as the various river systems within Bristol Bay.

Subsistence users harvest sockeye salmon in many areas of the state. The greatest subsistence harvest of sockeye salmon probably occurs in the Bristol Bay area where participants use set gillnets. In other areas of the state, sockeye salmon may be taken for subsistence use in fishwheels. Most of the subsistence harvest consists of prespawning sockeye salmon, but a relatively small number of postspawning sockeye salmon are also taken. Personal use fisheries have also been established to make use of any sockeye salmon surplus to spawning needs, subsistence uses, and commercial and sport harvests. Personal use fisheries have occurred in Bristol Bay, where participants use set gillnets, as well as in Cook Inlet and Prince William Sound, where participants also use dip nets.

While most sockeye salmon production in Alaska results from the spawning of wild populations, some runs have been developed or enhanced through human effort. Although artificial propagation of sockeye salmon has proven difficult, notable success has been achieved at state-maintained hatcheries located on the upper Copper River in Prince William Sound and the Kasilof River on the Kenai Peninsula. A fish ladder installed on the Fraser River on Kodiak Island has also served to enhance sockeye salmon returns.

Text: Commercial Fisheries Management and Development Staff
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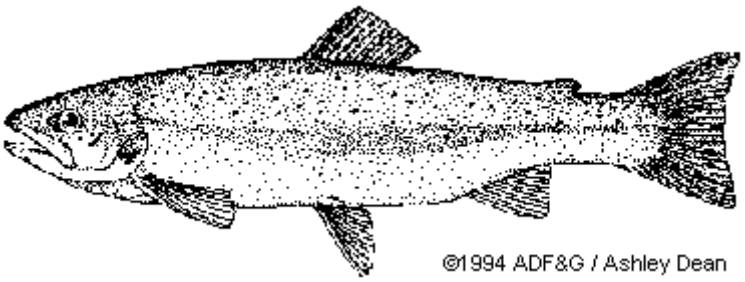
Rainbow Trout

The **rainbow trout** (*Oncorhynchus mykiss*), is one of the most respected and sought after of Alaska's native game fishes. Serious anglers from the world over are drawn to Alaska to experience the thrill of challenging this hard fighting salmonid in the state's wilderness waters.



Rainbow trout occur as both freshwater resident and sea-run races. Sea-going rainbows, known as steelhead trout, are discussed in a separate *Wildlife Notebook Series* account.

Rainbow trout are native to waters throughout Southeast Alaska west to Kuskokwim Bay, and as far up the Kuskokwim River as Sleetmute. The clearwater lakes and streams draining into Bristol Bay provide outstanding habitat. Rainbow trout occur naturally on the Kenai Peninsula, throughout the fresh waters of Upper Cook Inlet, on Kodiak Island, and in the Copper River drainage. Release of hatchery-reared Alaska rainbow trout has extended the range of resident rainbows to specific lakes and streams in the Tanana River drainage near Fairbanks.

General description: Rainbow trout possess the well-known streamlined salmonid form, though body shape and coloration vary widely and reflect habitat, age, sex, and degree of maturity. The body shape may range from slender to thick. The back may shade from blue-green to olive. There is a reddish-pink band along each side about the midline that may range from faint to radiant. The lower sides are usually silver, fading to pure white beneath. Small black spots are present over the back above the lateral line, as well as on the upper fins and tail. In some locations, the black spots of adults may extend well below the lateral line and even cover the entire lower side. Rainbow trout are positively identified by the 8 to 12 rays in the anal fin, a mouth that does not extend past the back of the eye, and the lack of teeth at the base of the tongue. River or stream residents normally display the most intense pink stripe coloration and heaviest spotting followed by rainbows from lake and lake-stream systems. Spawning trout are characterized by generally darker coloration.

Life history: During late winter or early spring, when water temperatures are on the rise, the maturing adult rainbows usually seek out the shallow gravel riffles or a suitable clearwater stream. Spawning takes place from late March through early July, depending upon the specific location and the severity of the winter. The female uses her tail to prepare a redd, or nest, 4 to 12 inches deep and 10 to 15 inches in diameter. From 200 to 8,000 eggs are deposited in the redd, fertilized by a male, and covered with gravel.

Hatching normally takes place from a few weeks to as much as four months after spawning, depending upon the water temperature. A few more weeks may be required for the tiny fry to emerge from the gravel. Upon emergence, the small trout assemble in groups and seek shelter along the stream margins or protected lake shore, feeding on crustaceans, plant material, and aquatic insects and their larvae. Rainbow trout rear in similar habitat for the first two or three years then move into the larger water of lakes and streams and turn more to a diet of fish, salmon carcasses, eggs, and even small mammals.

Age of onset of sexual maturity varies markedly between individuals due primarily to such factors as population density, productivity of the aquatic environment, and genetic makeup. In the wild, male and female spawners as young as ages 3 and 5, respectively, have been found, but a majority of both sexes mature at age 6 to 7. Spawning frequency ranges from annually to once each three years. Rainbow up to age 11 have been observed spawning.

Among resident rainbow, those living in or migrating to large lakes with sockeye salmon runs generally grow faster and larger than fish which remain year round in streams.

Fishing: Fishing success is typically greatest in the spring and fall, that is, before and after the large salmon runs. Rainbow trout are voracious feeders and strong swimmers willing to hit a wide variety of lures, baits, and flies. Weighted spinners are preferred by many anglers. The wobbling spoon is another fine rainbow getter. Fly fishers find that streamers, muddlers, and egg patterns fished near the bottom can be depended on to do the trick; black and red, especially fluorescent red, seem to add something of value.

Alaska manages rainbow trout fisheries for the health of the species and for a diversity of recreational angling experiences. Wild trout are abundant over most of their range, but daily bag and size limits are intentionally conservative. Artificial lure-only regulations are commonly used to reduce angling mortality. Many of the heavily fished waters are closed to trout fishing during the spawning period to further protect these valuable fish. Specific trout waters have been designated catch-and-release or trophy fisheries to help enhance the quality of the

fishing experience or preserve an abundance of large fish. Anglers who wish to take rainbow primarily for the pan are encouraged to visit one of the hundred or more lakes stocked annually with Alaska rainbow trout.

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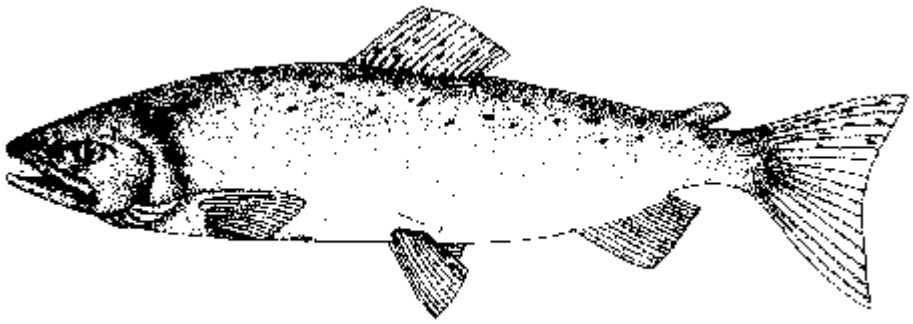
Coho Salmon



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Coho Salmon (*Oncorhynchus kisutch* (Walbaum)) also called silver salmon, are found in coastal waters of Alaska from Southeast to Point Hope on the Chukchi Sea and in the Yukon River to the Alaska-Yukon border. Coho are extremely adaptable and occur in nearly all accessible bodies of fresh water-from large transboundary watersheds to small tributaries.

General description: Adults usually weigh 8 to 12 pounds and are 24 to 30 inches long, but individuals weighing 31 pounds have been landed. Adults in salt water or newly arrived in fresh water are bright silver with small black spots on the back and on the upper lobe of the caudal fin. They can be distinguished from chinook salmon (*Oncorhynchus tshawytscha*) by the lack of black spots on the lower lobe of the tail and gray gums; chinook have small black spots on both caudal lobes and they have black gums. Spawning adults of both sexes have dark backs and heads with maroon to reddish sides. The males develop a prominent hooked snout with large teeth called a kype. Juvenile coho salmon have 8 to 12 parr marks evenly distributed above and below the lateral line with the parr marks narrower than the interspaces. The adipose fin is uniformly pigmented. The anal fin has a long leading edge usually tipped with white, and all fins are frequently tinted with orange.

Life history: Coho salmon enter spawning streams from July to November, usually during periods of high runoff. Run timing has evolved to reflect the requirements of specific stocks. In some streams with barrier falls, adults arrive in July when the water is low and the falls are passable. In large rivers, adults must arrive early, as they need several weeks or months to reach headwater spawning grounds. Run timing is also regulated by the water temperature at spawning grounds: where temperatures are low and eggs develop slowly, spawners have evolved early run timing to compensate; conversely, where temperatures are warm, adults are late spawners. Adults hold in pools until they ripen, then move onto spawning grounds; spawning generally occurs at night. The female digs a nest, called a redd, and deposits 2,400 to 4,500 eggs. As the eggs are deposited, they are fertilized with sperm by the male. The eggs develop during the winter, hatch in early spring, and the embryos remain in the gravel utilizing the egg yolk until they emerge in May or June. The emergent fry occupy shallow stream margins, and, as they grow, establish territories which they defend from other salmonids. They live in ponds, lakes, and pools in streams and rivers, usually among submerged woody debris-quiet areas free of current-from which they dart out to seize drifting insects.

During the fall, juvenile coho may travel miles before locating off-channel habitat where they pass the winter free of floods. Some fish leave fresh water in the spring and rear in brackish estuarine ponds and then migrate back into fresh water in the fall. They spend one to three winters in streams and may spend up to five winters in lakes before migrating to the sea as smolt. Time at sea varies. Some males (called jacks) mature and return after only 6 months at sea at a length of about 12 inches, while most fish stay 18 months before returning as full size adults.

Little is known of the ocean migrations of coho salmon. High seas tagging shows that maturing Southeast Alaska coho move northward throughout the spring and appear to concentrate in the central Gulf of Alaska in June. They later disperse towards shore and migrate along the shoreline until they reach their stream of origin.

Commercial fishing: The commercial catch of coho salmon has increased significantly from low catches in the 1960s, reaching 6.25 million fish in 1986. About half of the catch was taken in Southeast Alaska, primarily by the troll fishery.

Sport fishing: The coho salmon is a premier sport fish and is taken in fresh and salt water from July to September. In 1986, anglers throughout Alaska took 201,000 coho salmon. In salt water they are taken by trolling or mooching (drifting) with herring or with flies or lures along shore. In fresh water they hit salmon eggs, flies, spoons, or spinners. Coho are spectacular fighters and the most acrobatic of the Pacific salmon, and on light tackle provide a thrilling and memorable fishing experience.

Text: Steve Elliott
Illustration by: Ashley Dean
Revised and reprinted 1994

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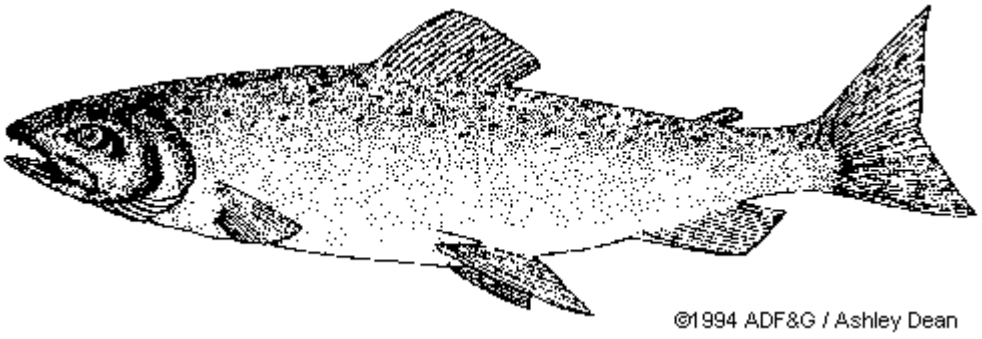
Last updated: 03/31/2002 12:20:02

Chinook Salmon

The **chinook salmon** (*Oncorhynchus tshawytscha*) is Alaska's state fish and is one of the most important sport and commercial fish native to the Pacific coast of North America. It is the largest of all Pacific salmon, with weights of individual fish commonly exceeding 30 pounds. A 126-pound chinook salmon taken in a fish trap near Petersburg, Alaska in 1949 is the largest on record. The largest sport-caught chinook salmon was a 97-pound fish taken in the Kenai River in 1986.



The chinook salmon has numerous local names. In Washington and Oregon, chinook salmon are called chinook, while in British Columbia they are called spring salmon. Other names are quinnat, tyee, tule, blackmouth, and king.

Range: In North America, chinook salmon range from the Monterey Bay area of California to the Chukchi Sea area of Alaska. On the Asian coast, chinook salmon occur from the Anadyr River area of Siberia southward to Hokkaido, Japan.

In Alaska, it is abundant from the southeastern panhandle to the Yukon River. Major populations return to the Yukon, Kuskokwim, Nushagak, Susitna, Kenai, Copper, Alsek, Taku, and Stikine rivers. Important runs also occur in many smaller streams.

General description: Adults are distinguished by the black irregular spotting on the back and dorsal fins and on both lobes of the caudal or tail fin. Chinook salmon also have a black pigment along the gum line which gives them the name "blackmouth" in some areas.

In the ocean, the chinook salmon is a robust, deep-bodied fish with a bluish-green coloration on the back which fades to a silvery color on the sides and white on the belly. Colors of spawning chinook salmon in fresh water range from red to copper to almost black, depending on location and degree of maturation. Males are more deeply colored than the females and also are distinguished by their "ridgeback" condition and by their hooked nose or upper jaw. Juveniles in fresh water are recognized by well-developed parr marks which are bisected by the lateral line.

Life history: Like all species of Pacific salmon, chinook salmon are anadromous. They hatch in fresh water, spend part of their life in the ocean, and then spawn in fresh water. All chinooks die after spawning. Chinook salmon may become sexually mature from their second through seventh year, and as a result, fish in any spawning run may vary greatly in size. For example, a mature 3-year-old will probably weigh less than 4 pounds, while a mature 7-year-old may exceed 50 pounds. Females tend to be older than males at maturity. In many spawning runs, males outnumber females in all but the 6- and 7-year age groups. Small chinooks that mature after spending only one winter in the ocean are commonly referred to as "jacks" and are usually males. Alaska streams normally receive a single run of chinook salmon in the period from May through July.

Chinook salmon often make extensive freshwater spawning migrations to reach their home streams on some of the larger river systems. Yukon River spawners bound for the extreme headwaters in Yukon Territory, Canada, will travel more than 2,000 river miles during a 60-day period. Chinook salmon do not feed during the freshwater spawning migration, so their condition deteriorates gradually during the spawning run as they use stored body materials for energy and for the development of reproductive products.

Each female deposits from 3,000 to 14,000 eggs in several gravel nests, or redds, which she excavates in relatively deep, moving water. In Alaska, the eggs usually hatch in late winter or early spring, depending on time of spawning and water temperature. The newly hatched fish, called alevins, live in the gravel for several weeks until they gradually absorb the food in the attached yolk sac. These juveniles, called fry, wiggle up through the gravel by early spring. In Alaska, most juvenile chinook salmon remain in fresh water until the following spring when they migrate to the ocean in their second year of life. These seaward migrants are called smolts.

Juvenile chinooks in fresh water feed on plankton, then later eat insects. In the ocean, they eat a variety of organisms including herring, pilchard, sandlance, squid, and crustaceans. Salmon grow rapidly in the ocean and often double their weight during a single summer season.

Commercial fishery and subsistence: North Pacific chinook salmon catches during the late 1970s and early 1980s averaged more than 4 million fish per year. The United States harvested the majority of the catch followed by Canada, Japan, and the USSR. Alaska's annual harvest during this period averaged about 731,000 fish per year, or about 32 percent of the North American catch. The majority of the Alaska catch is made in Southeast, Bristol Bay, and the Arctic-Yukon-Kuskokwim areas. Fish taken commercially average about 18 pounds. The majority of the catch is made with troll gear and gillnets.

There is an excellent market for chinook salmon because of their large size and excellent table qualities. Recent catches in Alaska have brought fishers nearly $19 million per year.

Catches by subsistence fishers in Southwest and Southcentral areas from 1976 through 1986 have averaged approximately 90,000 chinook salmon. Approximately 90 percent of the subsistence harvest is taken in the Yukon and Kuskokwim rivers.

Sport fishery: The chinook salmon is perhaps the most highly prized sport fish in Alaska and is extensively fished by anglers in the Southeast and Cook Inlet areas. Trolling with rigged herring is the favored method of angling in salt water, while lures and salmon eggs are used by freshwater anglers. The sport fishing harvest of chinook salmon is over 76,000 annually, with Cook Inlet and adjacent watersheds contributing over half of the catch.

Management: Unlike other salmon species, chinook salmon rear in inshore marine waters and are, therefore, available to commercial and sport fishers all year. Catches of chinook salmon in Southeast Alaska are regulated by quotas set under the Pacific Salmon Treaty. In other regions of Alaska, chinook salmon fisheries are also closely managed to ensure stocks of chinook salmon are not overharvested.

Text: Kevin Delaney
Illustration: Ashley Dean
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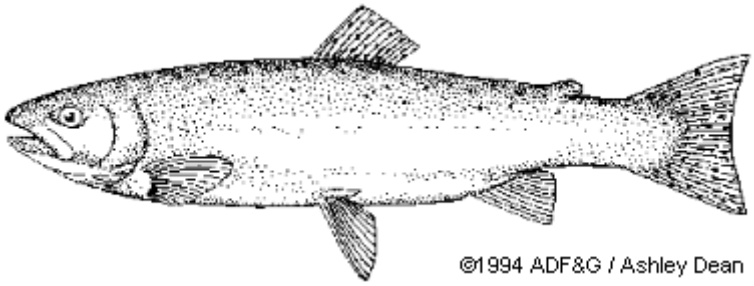
Steelhead Trout



The **steelhead trout** (*Oncorhynchus mykiss* *) is a rainbow trout that has spent a part of its life in the sea. There are no major physical differences between rainbow and steelhead trout; however, the nature of their differing lifestyles has resulted in subtle differences in color, shape, and general appearance.

General description: Like all trout, the steelhead are positively separated from the various salmon species by having eight to twelve rays in the anal fin. The rainbow trout/steelhead group are then separated from the brook trout, lake trout, and Dolly Varden by the complete absence of teeth at the base of the tongue. Generally speaking, steelhead are more slender and streamlined than resident rainbow. Like rainbow, the coloration on the back is basically blue-green shading to olive with black, regularly spaced spots. The black spots also cover both lobes of the tail. The black coloration fades over the lateral line to a silver white coloration blending more to white on the stomach. Steelhead from the ocean are much more silver than the resident rainbow. On steelhead the typical colors and spots of the trout appear to be coming from beneath a dominant silvery sheen. The silvery sheen gradually fades in fresh water, and steelhead become difficult to differentiate from resident rainbow trout as the spawning period approaches. Steelhead and rainbow lack the red slash on the underjaw characteristic of cutthroat trout, but do have white leading edges on the anal, pectoral, and pelvic fins. Spawning steelhead and rainbow develop a distinct pink to red strip-like coloration that blends along the side, both above and below the lateral line. On steelhead, the rainbow trout coloration gradually fades following spawning to the more characteristic silvery color that the fish display during their ocean journey. The distinct and beautiful coloration of steelhead during the freshwater spawning period is apparently important in regard to the mating and reproductive process. The silvery sheen and streamlined shape of ocean-bright steelhead is essential to survival in the ocean environment.

Juvenile steelhead trout are identical to rainbow trout until the period prior to their ocean migrations. Young trout and stunted adults have eight to thirteen parr marks on their sides. There are five to ten parr marks between the head and dorsal fin. Prior to migrating to the sea, juvenile steelhead become very silvery and resemble miniature adults. They are called smolt during this life phase.

Distribution: Steelhead are found in the coastal streams of Alaska from Dixon Entrance northward and west around the Gulf of Alaska down to the Cold Bay area on the Alaska Peninsula. There are no documented populations of steelhead on the Alaska mainland west of the Susitna River and north of the Chignik River system. This area is generally known as Bristol Bay and contains excellent resident rainbow trout populations but no steelhead.

We have little information on the ocean migration of Alaska steelhead; however, large numbers are intercepted in high seas fisheries, and undoubtedly many of these fish are of Alaska origin. Steelhead migrate to areas west of the Aleutian Islands and are routinely caught in net fisheries off the coast of Japan.

Life history: When compared to the mundane habits of resident trout, steelhead lead a very complicated and dangerous life. Each spring thousands of 6-inch steelhead smolt leave the streams to begin their ocean journeys. For every 100 smolt that reach the sea, only five to ten will return as a first-spawning adult. Within a one-, two-, or sometimes three-year period, Alaska steelhead will have moved hundreds of miles from the parent stream. Some populations return to the home stream as early in the year as July and are known as “summer steelhead.” Summer steelhead are relatively rare in Alaska and found in only a few select Southeast Alaska streams. “Fall” run steelhead are much more common, particularly in the systems north of Frederick Sound. These fish enter the freshwater systems as adults in August, September, October, and on into the winter. Anchor, Naha, Karluk, and Situk rivers have good runs of fall run steelhead. Many of the Southeast Alaska systems have spring run steelhead. These fish end their ocean journeys in mid-April, May, and June. In many rivers, bright, shiny spring run fish can be observed mixed with rainbow-marked spawners that have spent the entire winter waiting for the spring spawning period.

Spawning commences about mid-April and usually occurs throughout May and early June. A male may spawn with several females, and more males than females die during the spawning period.

Unlike salmon, steelhead commonly spawn more than once, and fish over 28 inches are almost always repeat spawners. The ragged and spent spawners move slowly downstream to the sea, and the spawning, rainbow colors of spring return to a bright silvery hue. Lost fats are restored and adults again visit the feeding regions of their first ocean migration. On rare occasions a fish will return to the stream within a

few months, but most repeat spawners spend at least one winter in the sea between spawning migrations.

While adult spawning wounds are healing and growth resumes, the eggs which were deposited deep in the gravel during the spring quickly develop into alevins or "sac-fry". These tiny fish gradually absorb the yolk sac and work their way to the surface. By mid-summer fry emerge from the gravel, minus the yolk sac, and seek refuge along stream margins and in protected areas. Tremendous numbers of eggs and fry are killed or washed from the stream each year, but by fall 2- to 3-inch steelhead populate habitat that, hopefully, will carry them through the first winter. Generally, the juvenile steelhead will remain in the parent stream for about three years before outmigrating to salt water.

If all steelhead left the stream at the same age, returned after the same length of time in the ocean, and died after spawning, the adults in a given stream would be of similar age. They don't. Add to this the complications of summer run, spring run, and fall run fish spawning at the same time and in the same stream, and you have a rather complicated situation. Perhaps nature has conspired to make steelhead life history complicated so that a harsh flood, winter, or drought does not destroy all of a given population.

Sport fishing: Adult steelhead like fast, deep, running water. Fish the deep holes in the stream. Fish the fast, white water areas and behind rocks and log jams. Quite often large holes form in front of log jams and these areas should not be overlooked.

Steelhead like colorful flies such as the Russian River coho, hair skyhomish, skyhomish sunrise, red rascal, and polar shrimp. Confusing? Try egg imitations. A single hook with a tuft or strand of orange yarn is often just the ticket for steelhead. Hardware works too, and small spoons to large spinners will catch steelhead.

Catch-and-release: Anglers are encouraged to practice catch-and-release when fishing for steelhead. When rigging for steelhead, consider removing the barbs from your terminal gear. Steelhead are usually hooked in the outer mouth parts. This means that they will live to spawn or bite again if gently released. Removing the barb from your hook will allow you to release the fish without even taking it from the water. While it is legal to take steelhead, these stocks are limited and easily overexploited. By practicing catch-and-release and limiting harvest of steelhead, fishers can help maintain this species.

*Use a single hook, artificial lure or fly.
*Land fish quickly.
*Handle fish with wet hands, no net.
*Keep fish in water, handling gently.
*Keep hands and fingers away from gills.
*Carefully remove hook or cut line.
*Revive fish by moving it gently back and forth in the water before releasing it.

Text: Frank Van Hulle
Illustration: Ashley Dean

***** The scientific name for steelhead has been revised. This page shows the current and correct scientific name. (In 1988, The American Fisheries Society published a symposium proceedings (cited below) and in that document they included a paper by Robert L. Kendall, the Managing Editor of the American Fisheries Society on Nomenclatural Changes. For additional information see the following: Gresswell, R. E. 1988. Status and management of interior stocks of cutthroat trout. American Fisheries Society Symposium 4.)

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Summary of life history of upper Copper River fish

	Spawning	Egg Hatching	Juv. Emigration	Years in stream	Ocean Years	Total age
Sockeye / Red	Late Summer	Spring	Peak in June	1	2 – 4 (mostly 3)	1.3 or 1.2
Chinook / King	Late summer	Spring	Spring / summer	1	1 – 4 (mostly 3)	1.3 or 1.4
Coho / Silver	Fall	Spring	Spring / summer	1 or 2	1	1.1 or 2.1
Steelhead	Spring	mid-July	Spring-summer?	3 (80%)	2 –3 (mostly 2)	3.2 or 3.3
Rainbow	Late Spring			4 – 10 (Average = 6)		4-10

Key life stages of some upper Copper River fish – Return Spawning

- **Sockeye and chinook salmon**
  - **Enter river starting in spring, continue through July**
  - **Spawn primarily in headwaters in upper drainage**

- **Coho salmon**
  - **Enter river later, in summer, continue into early fall**
  - **Spawn in many sloughs in lower river, also in small streams in upper river**

- **Steelhead**
  - **Enter river in summer, fall, then spawn in late winter / early spring**
  - **Spawn in headwaters in upper drainage**

- **Rainbow**
  - **Remain in freshwater throughout life, spawning in late winter / early spring**
  - **Can spawn in streams, lakes**

- **Sources of mortality (all fish) – predation, predation, predation**

Key life stages of some upper Copper River fish – Egg Incubation and Hatching

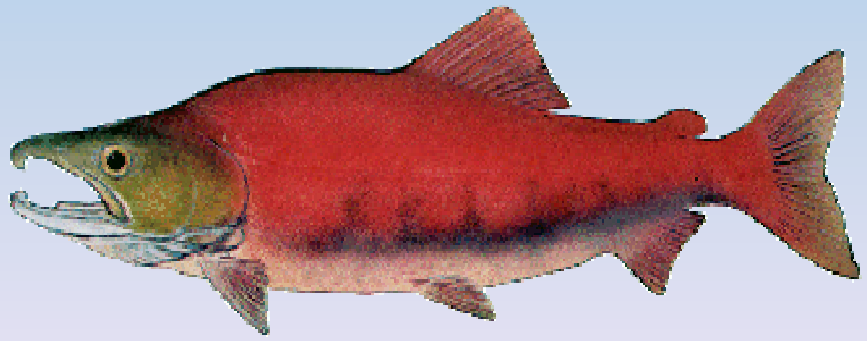
- **Thermal Unit – Measurement of days spent above 32 degrees**
  - **1 TU = 24 hours at 1 degree above 32**
  - **General rule – salmon eggs need 50 days at 50 degrees:**
    - **50 days x 18 degrees = 900 TU**
- **This is why salmon incubation times (4-6 months) are longer than trout incubation times (2 months)**
- **Sources of mortality: Freezing, dewatering, siltation, predation**

Key life stages of some upper Copper River fish – Juvenile emigration

- Summer months
- Often a diurnal component to them
- Most Copper River salmon probably feed
- Most upper Copper River fish need to spend at least 1 year before being large enough to undertake journey
- Big source of mortality - predation

Key life stages of some upper Copper River fish – Ocean life

- Substantial differences within species
- Probable range is throughout GOA
- Wide range in return time
- Coho and chinook - fish eaters
- Sockeye – more plankton



Appendix C - Visuals for Module II, Management of Copper River salmon

Copper River Fish Management - 3 fisheries

- Commercial fishery in lower river
- Subsistence fishery in upper, lower river
- Sport fishery

Subsistence fishery

- All subs. fisheries recognized by state, federal govs.
- Federal gov. can exercise priority in times of shortage
- Both federal and state users obtain and return permits to state

Subsistence fishery

- **Both State and Federal**
- **State**
  - **Glenallen Subdistrict**
  - **Chitina Subdistrict**
- **Federal**
  - **Glenallen Subdistrict**
  - **Batzulnetas**

Sport Fish

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Copper River Salmon Subsistence Fisheries

Chitina Home
UCUS area Fishing Update

Fishing Schedules

Chitina Subdistrict

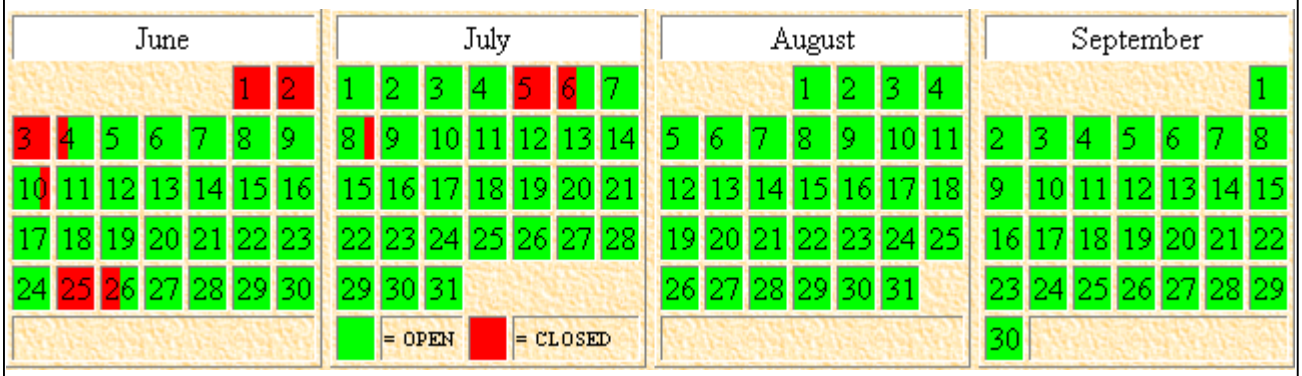
ATTENTION: The road from O'Brien Creek to Haley Creek has been closed to all traffic (see News Release 7/25/2001 and 8/22/2001)

EOs	NRs by date
	8/22/2001
	7/25/2001
3-RS-07-01	7/02/2001
3-RS-05-01	6/25/2001
3-RS-04-01	6/18/2001
3-RS-03-01	6/11/2001
3-RS-02-01	6/04/2001
3-RS-01-01	5/30/2001
	5/03/2001

Under the Copper River Subsistence Salmon Fisheries Management Plan salmon may be taken in the Chitina Subdistrict from June 1 through September 30 **during periods established by Emergency Order** (EO). A News Release (NR) was issued on May 3, 2001 establishing a **Preseason** Schedule for the season. Emergency orders are issued during the season to adjust this schedule based on escapement estimates at the Miles Lake sonar. Information regarding fishery openings will be updated and posted here if changes are made by emergency order. In weeks when a harvestable surplus of 50,000 salmon or greater will be available in the Chitina Subdistrict, a supplemental harvest period will be announced. A supplemental harvest period allows permit holders who have filled their original limit to take 10 additional sockeye salmon.

2001 Copper River Chitina Subdistrict Subsistence Salmon Fishery Schedule

OPENS	CLOSES	Hours	Sup.?*
Monday, June 4, **8:00 AM**	Sunday, June 10, **8:00 PM**	156	Yes
Monday, June 11, **12:01 AM**	Sunday, June 17, **midnight**	168	Yes
Monday, June 18, **12:01 AM**	Sunday, June 24, **midnight**	168	No
Tuesday, June 26, **noon**	Sunday, July 1, **midnight**	132	No
Monday, July 2, **12:01 AM**	Wednesday, July 4, **midnight**	72	No
Friday, July 6, **noon**	Sunday, July 8, **8:00 PM**	56	No
Monday, July 9, **12:01 AM**	Friday, August 31, **midnight**	1296	No
Saturday, September 1, **12:01 AM**	Sunday, September 30, **midnight**	Continuous	No



This schedule valid through September 30, 2001 *Sup. = Supplemental Period

Glennallen Subdistrict

The subsistence fishery in the Glennallen subdistrict is open from June 1 through September 30.

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Number of permits issued and salmon harvested during the Glennallen Subdistrict subsistence salmon fishery in the Copper River, 1977-2000.

Year	Number Permits Issued	Estimated Salmon Harvest			
		Chinook	Sockeye	Coho	Total[d]
1977	4,066	857	15,790	34	45,208
1978	3,705	453	6,406	188	28,715
1979	3,200	1,596	18,795	134	37,585
1980	3,203	845	15,811	105	35,100
1981	4,078	585	30,545	193	68,687
1982	6,090	681	39,968	292	109,726
1983	7,541	1,275	37,596	447	118,734
1984	475	509	27,941	167	28,631
1985	-[a]	629	30,666	294	31,614
1986	405	686	27,441	291	28,423
1987	445	813	33,106	161	34,142
1988	417	992	29,194	372	30,755
1989	386	787	28,360	69	29,308
1990	406	647	31,765	92	32,524
1991	712	1,328	39,599	232	41,205
1992	655	1,449	45,232	350	47,095
1993	773	1,434	53,252	77	54,854

1994	970	1,989	68,278	60	70,391
1995	858	1,892	52,516	882	55,323
1996	850	1,482	52,052	557	54,290
1997	1,133	2,583	82,807	187	85,744
1998	1,010	1,842	64,463	533	66,951
1999	1,102	3,278	77,369	1,121	82,119
2000	1,253	4,856	59,497	532	64,885
2001[d]	1,240	3,522	82,635	1,111	87,268
1977-1989	2,834	824	26,278	211	48,202
1990-1999	847	1,792	56,733	409	59,050
1995-1999	991	2,215	65,841	656	68,885

[a] Data not available.
[b] Total harvest includes steelhead and other species.
[c] Total harvest prior to 1984 includes both harvest from the Chitina and Glennallen Subdistricts.
[d] Preliminary estimates.

Number of permits issued and salmon harvested during the Chitina Subdistrict subsistence salmon fishery in the Copper River, 1984-2000.[a]

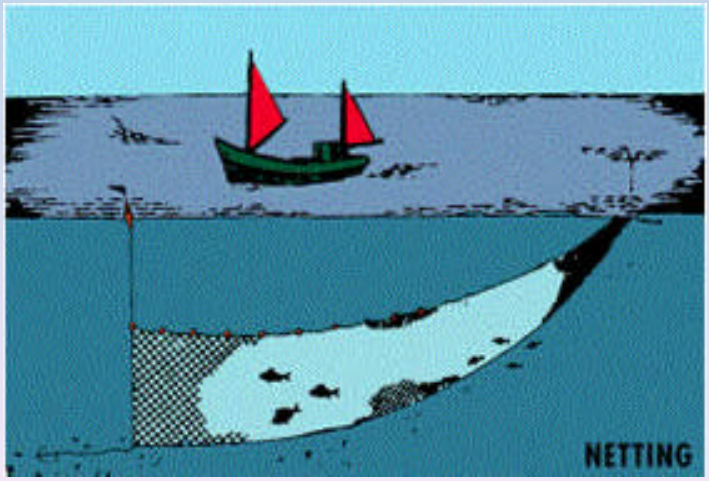
Year	Number Permits Issued	Estimated Salmon Harvest			
		Chinook	Sockeye	Coho	Total[d]
1984	5,415	1,760	48,236	717	50,734
1985	---[b]	1,329	30,885	361	32,586
1986	4,031	2,367	41,054	538	44,047
1987	4,245	2,968	43,492	424	46,908
1988	4,251	2,994	42,331	504	45,855
1989	4,582	2,251	55,778	857	58,941
1990	5,689	2,708	66,432	1,511	70,812
1991	6,222	4,056	77,590	3,354	85,059
1992	6,385	3,405	86,724	1,517	91,683
1993	7,914	2,846	93,472	1,416	97,767
1994	7,061	3,743	94,024	1,981	99,822
1995	6,760	4,707	79,006	4,870	88,617
1996	7,198	3,584	95,007	3,381	102,108
1997	9,086	5,447	148,727	160	154,349
1998	10,006	6,723	137,161	2,145	146,075
1999	9,943	5,913	141,658	2,174	149,779
2000	8,151	3,168	107,856	3,657	114,681
2001[c]	9,462	3,104	133,464	2,584	139,152
1990-1999	7,090	4,313	101,980	2,251	108,607
1995-1999	8,022	5,275	120,312	2,546	128,186

[a] From 1984 - 1999 the Chitina Subdistrict was classified a personal use fishery.
[b] Data not available.
[c] Preliminary estimates.
[d] Total estimate includes unidentified salmon.

Commercial fishery

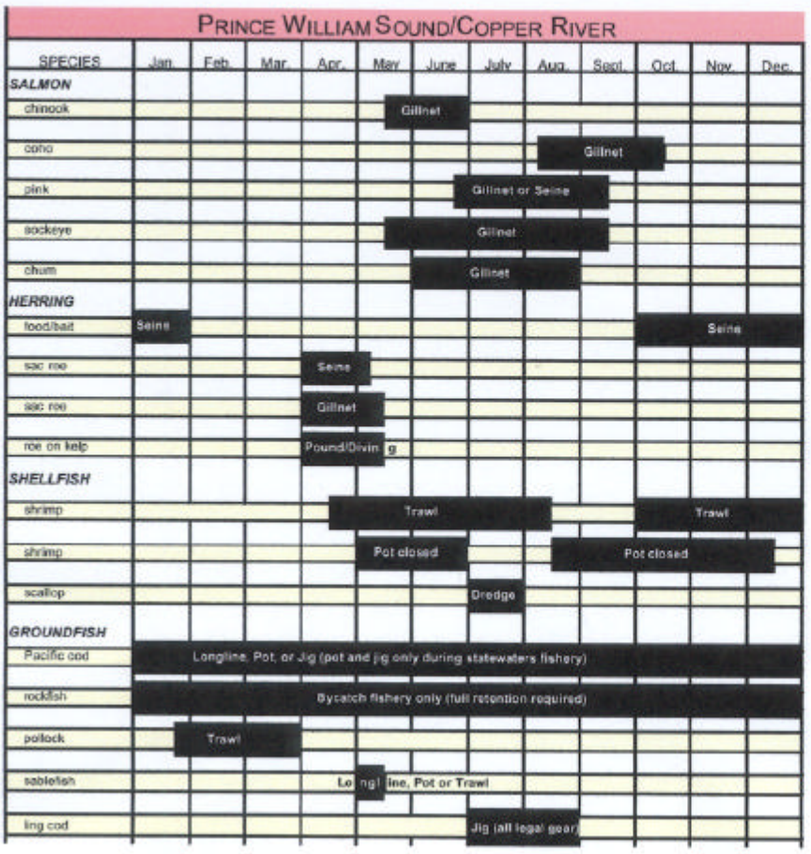
- Managed by State
- Prince William Sound mgmnt area
  - Copper River District

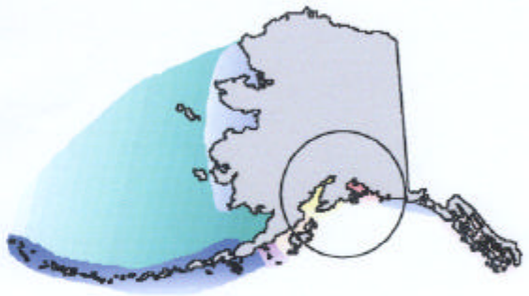
- Season opened and closed by EO
- Salmon taken by gillnetters, seiners

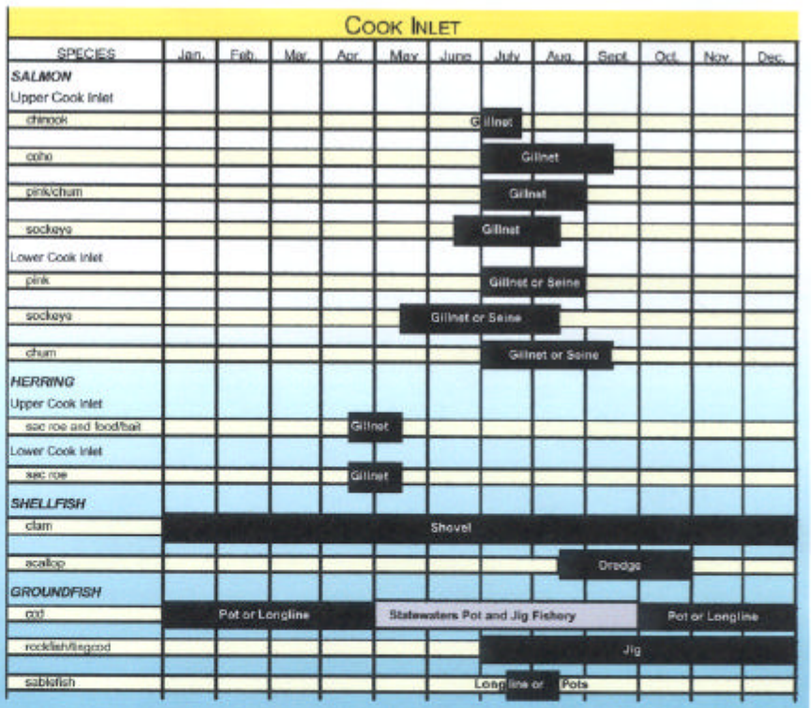


Commercial Fishing Seasons In Alaska

Prince William Sound/Copper River
Cook Inlet







Alaska Department of Fish and Game
Division of Commercial Fisheries
PO 25526
Juneau, AK 99802
Doug Mecum, Director
(907)465-4160
www.cf.adfg.state.ak.us

V. 2 © 2000 ADF&G/CF

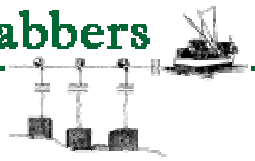
Purse Seiner

Purse seiners catch salmon (primarily pink salmon) and herring by encircling them with a long net and drawing (pursing) the bottom closed to capture the fish. The net is first stacked on the stern of the boat and then payed into the water while the boat travels in a large circle around the fish. The far end of the net is attached to a “power skiff,” which helps the operation by holding the net while the seiner completes the circle. The top of the net stays on the surface of the water because of its “float line” that runs through thousands of colorful floats, and the bottom of the net falls vertically because of its weighted “lead line.” As a result, the net hangs like a curtain around the school of fish. The vessel crew then purses its bottom with a “purse line.” The lines, and thus the net, are retrieved through a hydraulic power block (winch). Once most of the net has been retrieved, with the remainder of it lying in a “bag” alongside the vessel, the fish are dipped from the bag and into the vessel’s hold. For large catches of herring, a buying vessel or “tender” comes alongside the fishing vessel and lowers the end of a fish pump into the bagged purse seine. The herring are then pumped aboard the tender and into its hold without ever going aboard the seiner.

Sometimes referred to as “limit seiners,” purse seiners are sleek, cabin-forward vessels that are limited by Alaska law to 58' in order to more precisely manage their fishing effort. They are recognized by their long, clean decks, the boom with its power block, the net stacked on the back, and the power skiff that is often seen riding “piggyback” aboard the vessel’s stern while it is traveling. When fishing, of course, the circle of floats on the surface of the water, and the power skiff assisting with the operation, are sure giveaways.

Seine-caught salmon are delivered “in-the-round” (whole) to buying stations and canneries where they end up as canned and frozen products. Herring are delivered to processing plants where they are either stripped of their roe (eggs), or packaged as bait for other commercial fisheries; e.g., the longline fisheries and the crab fisheries. Salted herring roe, called “kazunoko,” is shipped to Japan where it is a high-priced delicacy.

Crabbers



Crabbers target Dungeness, king, and Tanner crabs using twine or wire-meshed steel pots (traps). Baited with herring or other fresh bait, the pots are left to “soak” for several days. A line extends from each pot to a surface buoy that marks its location. There are several configurations for the pots, though in general, the smaller round pots are fished for Dungeness in shallow bays and estuaries, and the large, heavy, rectangular pots are fished in waters deeper than 100' for king and Tanner crab. A power winch is used to retrieve the pots. Once aboard, a pot is opened and the catch sorted. Females and undersized males are discarded (alive) over the side and legal-sized males are retained in aerated seawater tanks.

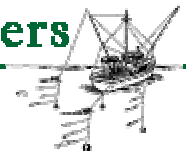
Crab boats come in a variety of shapes and sizes, from aluminum skiffs with outboard motors that fish the inside waters for Dungeness, to seagoing vessels of 100' or more that ply the Bering Sea and the Gulf of Alaska for king crab. Unless one happens to see a crabber headed for the fishing grounds with its decks stacked with pots,

identification of a vessel as a crabber might be difficult for the casual observer.

Crabs are delivered live to shore stations where they are cooked and then either canned or sold as a fresh or frozen product. A small number are sold live in local markets through retail outlets that have circulating seawater holding tanks.

Top of FAQ

Trollers



Troll vessels catch salmon, principally chinook, coho, and pink salmon, by “trolling” bait or lures through feeding concentrations of fish. The word “troll” comes from a medieval German word, “trollen,” and refers to the revolving motion of the bait or lures used in this type of fishing.

Typically, four main wire lines are fished, each of which has a large (40 lb), lead sinker (“cannon ball”) on its terminal end, and 8–12 nylon leaders spaced out along its length, each of which ends in either a lure or baited hook. To retrieve hooked fish, the main lines are wound about small, onboard spools via hand crank (hand trollers) or with hydraulic power (power trollers), and the fish are gaffed when alongside the vessel. The leaders are then rebaited and let back down to the desired depth(s).

Troll vessels come in a variety of sizes and configurations, ranging from small, hand troll skiffs to large, ocean-going power troll vessels of 50' or more in length. Troll salmon fishermen operate throughout Southeast Alaska in both state and federal waters.

The troll salmon fishery produces a low-volume, high-quality product. Troll-caught salmon are dressed at sea and sold either as a fresh or frozen product. Public markets and fine restaurants are the final destination.

Top of FAQ

Trawlers

Trawlers are sometimes confused with trollers due to their similar sounding names, though there are few similarities. Trawlers typically catch large quantities of midwater species, such as pollock or pink shrimp, and bottomfish, such as flounder, by towing a large, cone-shaped net. Most trawl nets have “doors” on either side of the net’s opening to help hold it open, and some, that are fished near the bottom, have a heavy chain strung along the bottom of the opening to hold it close to the sea floor. The net is retrieved via the use of huge winches and a power drum upon which the net is rolled as it is brought aboard. The end of the net, the “bag” or “cod end,” holds the fish and is usually pulled right up into the back of the vessel on a slanting stern ramp.

Trawlers are generally large vessels; the largest in the ocean pollock fishery are factory trawlers that possess onboard processing facilities. These can be up to 600' in length. Catches are often enormous, with a 2-hour tow of the net yielding up to 100 tons or more, depending on the fishery, the size of the vessel, and the concentration of fish in the area.

The trawl fishery may process its catches into fillets, as in the case of flounder destined for the fresh and frozen market, or minced fish called “surimi,” which is manufactured into fish sticks and similar products such as artificial king crab. Shrimp fishermen sort their catches by size and species and sell the product as either a whole, frozen

product, or as a headed, frozen product.

Top of FAQ

Longliner

Longliners catch bottomfish (primarily halibut, blackcod, lingcod, and rockfish) via a long line that is laid on the bottom. Attached are leaders (called gangions) with baited hooks. Each longline can be up to a mile in length and have thousands of baited hooks. The lines are anchored at each end of each “set.” Lines at the ends run to the surface and are marked with a buoy and flag. A longline vessel typically sets several lines for a 24-hour “soak.” The lines are retrieved over a side roller with a power winch, and the fish caught are bled or dressed and then packed in ice in the vessel’s hold.

Longliners are typically large vessels, 50' to 100' in length, with a weather cover on the stern to protect the crew. The longlines are coiled and stacked on deck in tubs when not in use. Most vessels in this fishery can pack 20 to 40 tons, or more, of iced product before returning to port. Longliners are readily identified by their weather cover and, when not fishing, by the numerous orange buoys and flags that are tied along their rails.

This fishery delivers its catch whole and bled (rockfish), or whole and gutted (halibut), or headed and gutted (blackcod and lingcod) for subsequent sale to fresh and frozen markets.

Top of FAQ

Gillnetter

Gillnetters catch salmon, primarily sockeye, chum, and coho, by setting curtain-like nets perpendicular to the direction in which the fish are travelling as they migrate along the coast toward their natal streams. The net has a float line on the top and a weighted lead line on the bottom. The mesh openings are designed to be just large enough to allow the male fish, which are usually larger, to get their heads stuck (“gilled”) in the mesh. Much larger fish and the smaller females are not so readily gilled. Gillnets work best in silty or turbid water which makes them difficult for the fish to see.

Gillnet vessels are usually 30' to 40' long. They are easily recognized by the drum on either the front (“bow picker”) or the stern (“stern picker”), on which the net is rolled. Net retrieval is by hydraulic power which turns the drum. Fish are removed from the net by hand “picking” them from the mesh as the net is reeled onboard.

Gillnet-caught salmon are usually iced and delivered to buyers and cold storages. Historically, their ultimate destination was the canned market, though a growing market for frozen product has developed overseas.

Top of FAQ

Sport fishery

- **Upper Copper falls in UCUSMA**
  - **HQ in Fairbanks, office in Glenallen**
- **Manages the state subsistence fishery in Glenallen. Chitina subdistricts**

Appendix D - Visuals for Module III, Introduction to escapement estimation and monitoring techniques

Escapement and indexing

- **Escapement**
  - **Estimating the actual number of fish that "escape" back to the river *for the entire season***
- **Indexing**
  - **Counting the number of fish present *at a given time or place***

Escapement

- **Inseason**
  - **Tells us how the run is doing**
- **Postseason**
  - **Tells us how the run did**

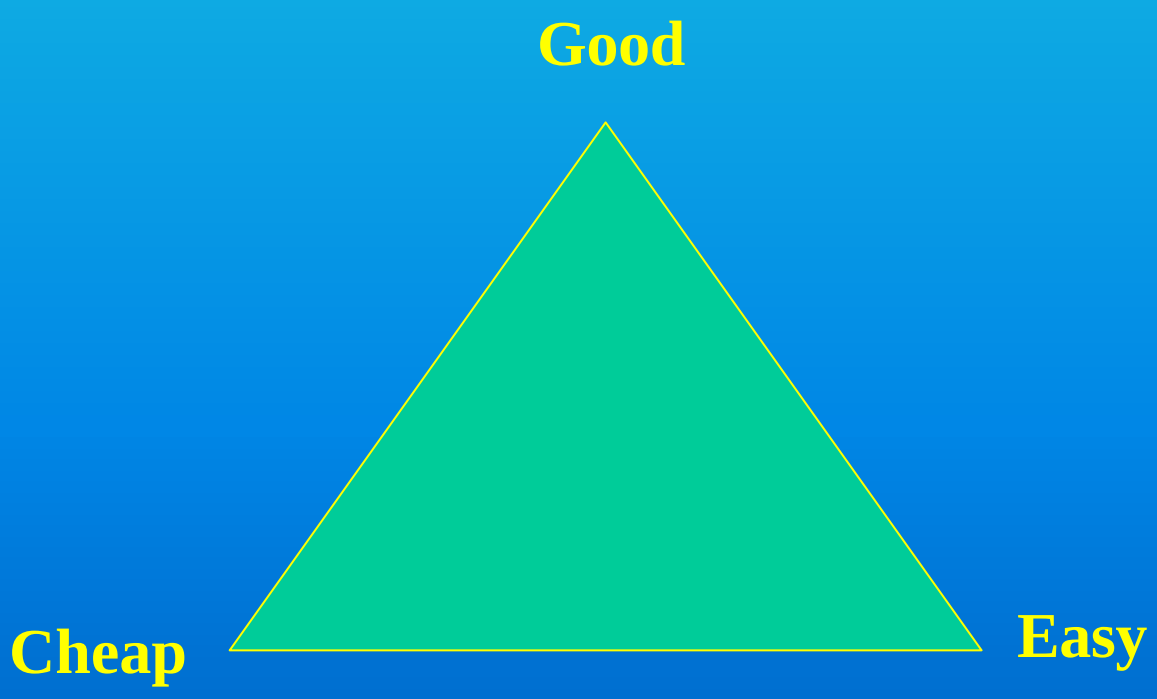
- **Both can:**
  - **Tell us how many fish**
  - **Help set seasons, limits**
  - **Assess change over time**

Escapement methods

- Weirs
  - (Fishways)
- Sonar
- Count Towers
- Mark-Recapture

No Magic Bullet

- **Method choice varies with habitat, goal, funding, fish behavior…….**



Methods used to monitor salmon escapement in Alaska, British Columbia and the Yukon Territory and relative ratings of accuracy, precision and cost.

Method	Cost	Potential Bias	Precision	ssess Problems?[1]	Limiting factors
Weir	High	Low	high	Easy	Limited to small systems, favorable flow regimes
Counting tower	Mod.	Moderate	Mod to High	Moderate	Requires clear water and narrow migration corridors
Float/foot survey	Low	Moderate	Moderate	Moderate	Requires clear and accessible water
Aerial Survey	Low	High	Low to Mod.	Mod to Difficult	Requires clear water and open forest canopy
Mark-recapture	Mod to High	Moderate	Mod to High	Moderate	Need to live-capture fish for marking and access to live or dead fish later
Video	Low to Mod	Low	High	Easy	Requires clear water, substrate and sometimes partial weir
Resistivity	Low	Low	High	Easy	Stream depth and fish behavior
Acoustic	High	Mod to High	Mod to High	Mod to Difficult	Requires favorable substrate, bottom profile and fish behavior

[1] The degree to which problems associated with a given year's estimate can be assessed and quantified using the routinely collected data.

Escapement methods - Sonar

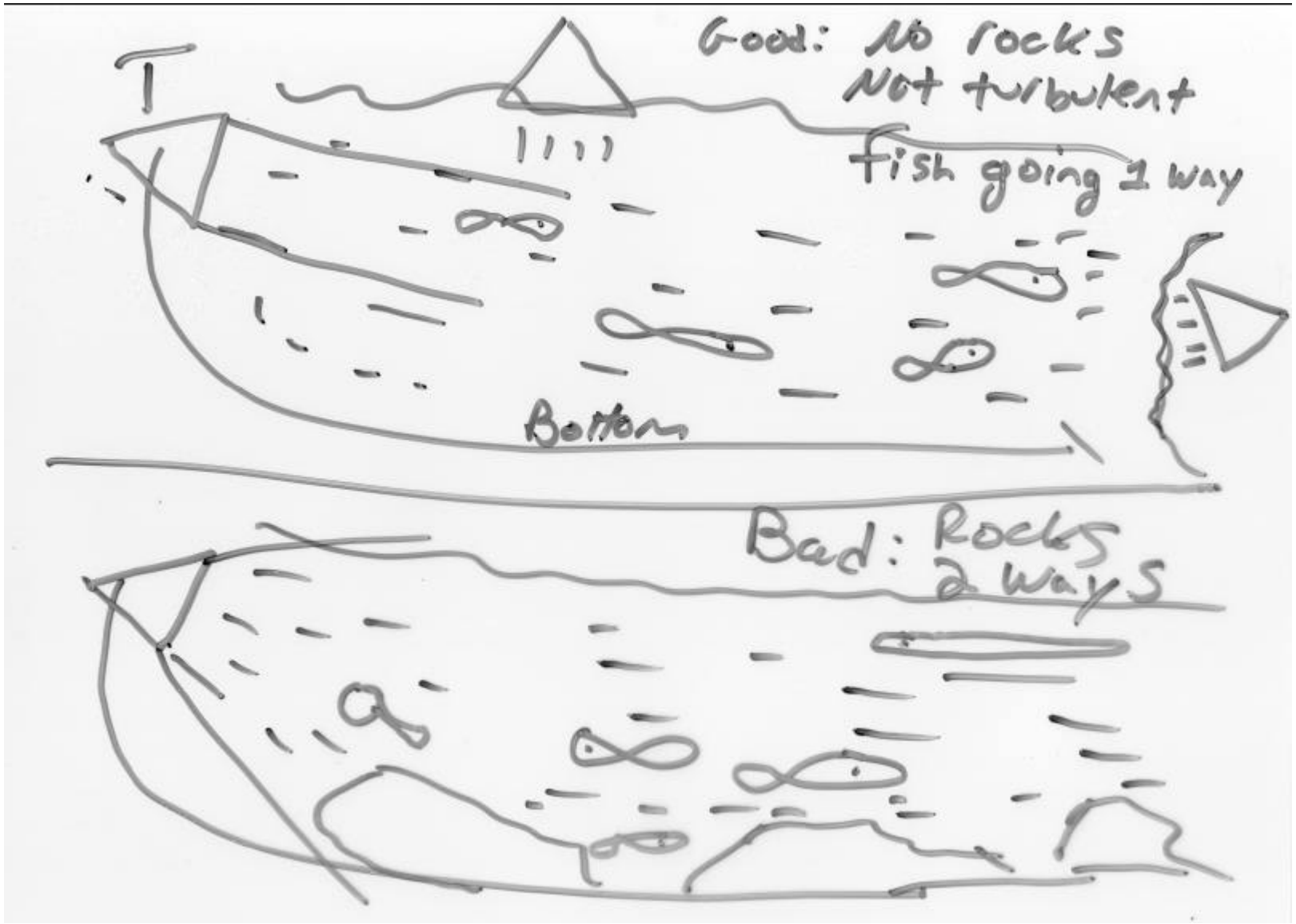
- Shoot acoustic beams through water
- Beams rebound off fish, return to sensor
- Very sensitive to bathymetry, fish behavior, substrate type
- Usually requires test fishery to determine species composition

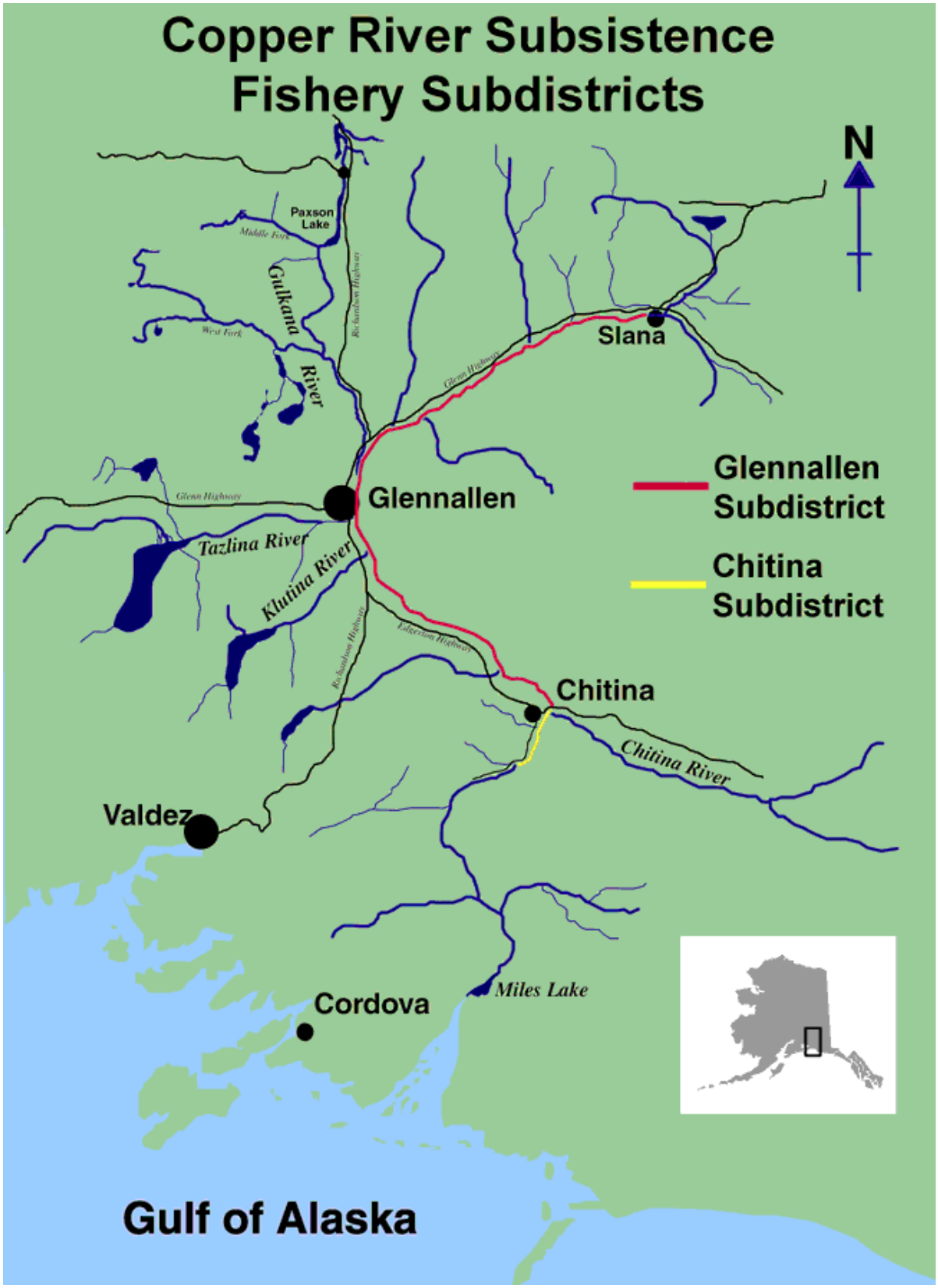
Escapement methods - Sonar

- Pros
  - In right spots, can yield good information on abundance, timing, and species
- Cons
  - High $$$
  - Can have moderate to high bias, precision
  - Can't assist with capture

Sonar

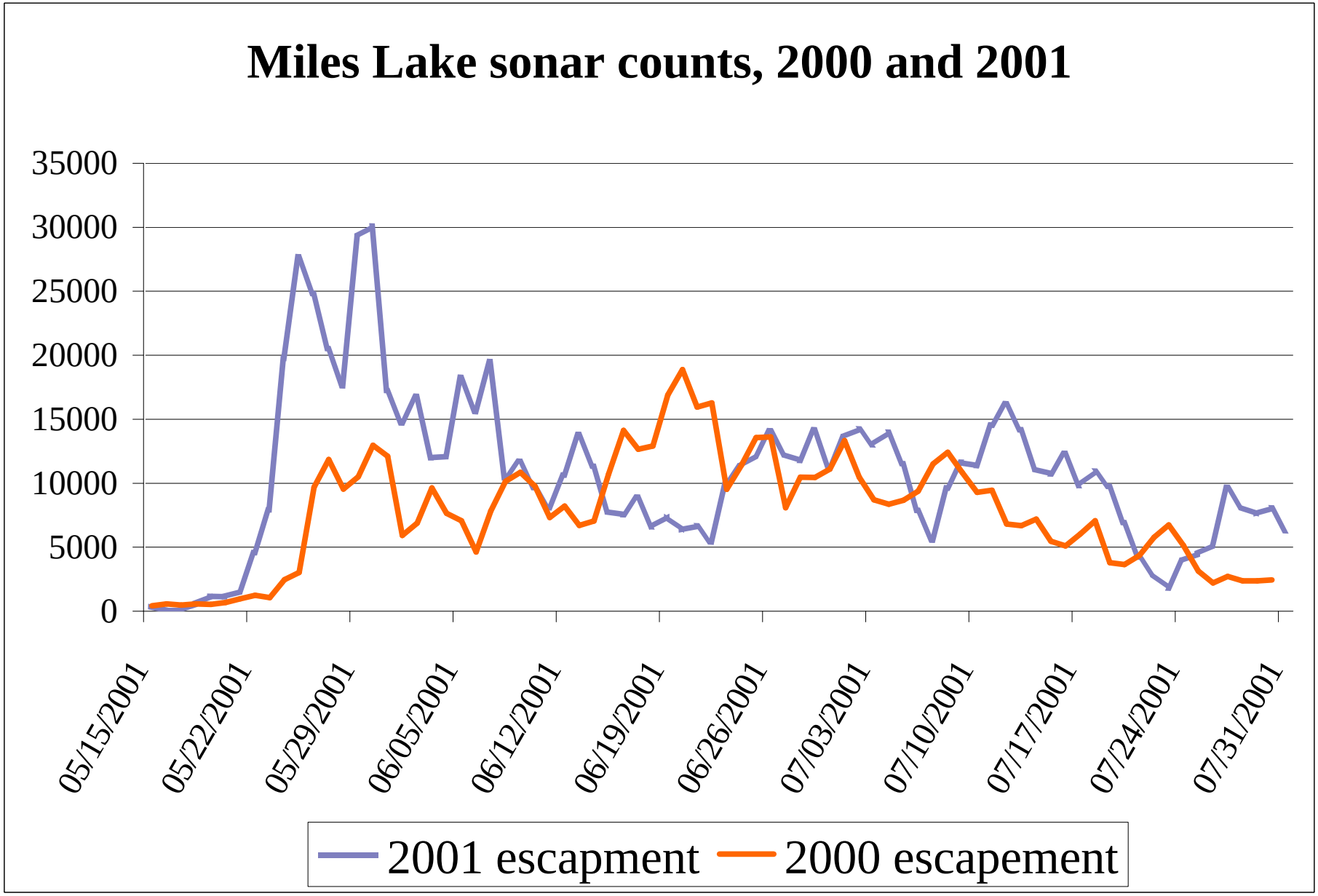
- Historical problems
  - Interference from rain, running water, silt, bottom disturbance
  - Multiple object problem
  - Too fine of detail – count false objects
  - Too rough detail – miss fish


Good: No rocks
Not turbulent
fish going 1 way
Bottom
Bad: Rocks
2 ways



Copper River Fishery Subdistricts

Copper River sonar – Miles Lake

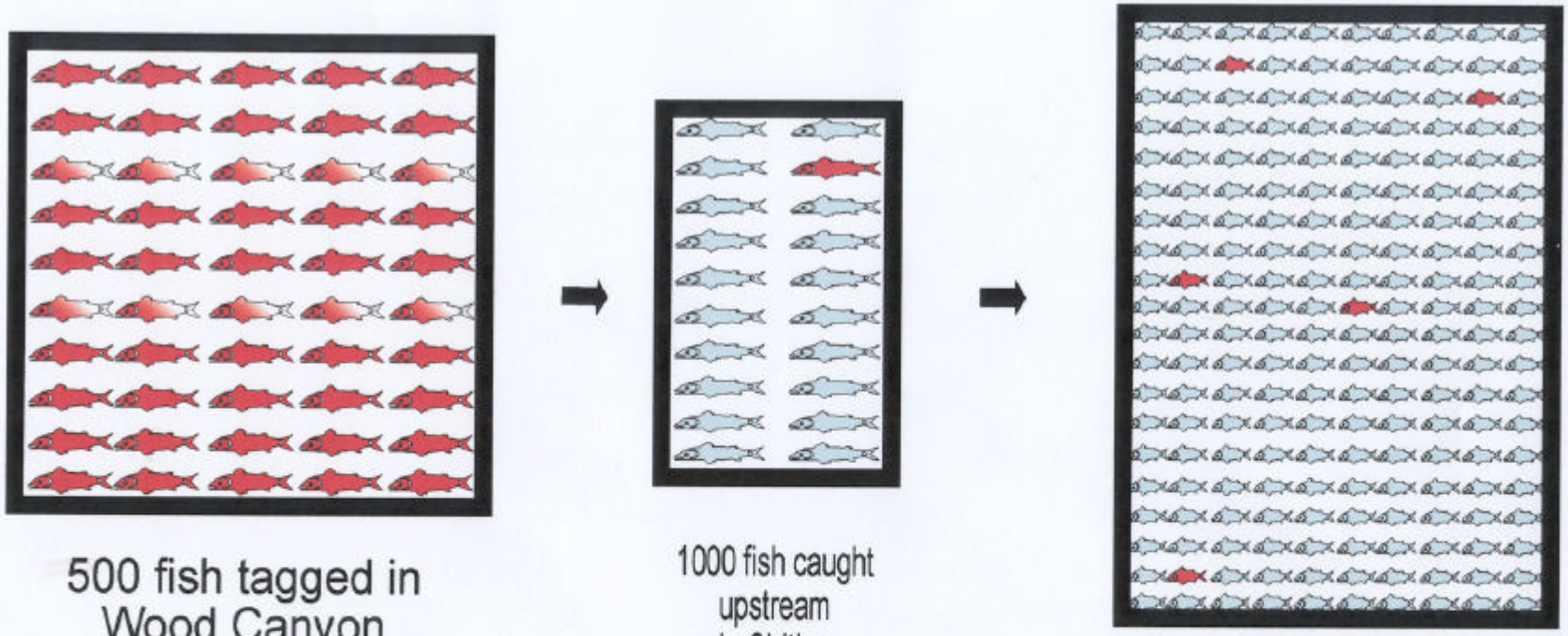

Miles Lake sonar counts, 2000 and 2001
35000
30000
25000
20000
15000
10000
5000
0
05/15/2001
05/22/2001
05/29/2001
06/05/2001
06/12/2001
06/19/2001
06/26/2001
07/03/2001
07/10/2001
07/17/2001
07/24/2001
07/31/2001
2001 escapment
2000 escapement

Copper River sonar – Miles Lake

- In operation since 1978
- Transducers on north and south bank
- 95% of run seems to be on south bank
- Concrete “substrate” extends from south bank – has railways irons
- May miss fish in middle

Escapement methods – Mark-Recapture

- Capture and mark fish at one place or time
- Recapture and check for marks at another place or time
- Works in lakes or rivers
- Use statistics to figure out how many fish were at FIRST place (or time)


500 fish tagged in
Wood Canyon
=
"M"
1000 fish caught
upstream
in Chitina
20 have marks
=
"C" and "R"
Estimate run at 25,000
fish
=
"N"

$$N = M \times C / R$$

M = # fish marked, 1st time

N = total # fish really there

C = # fish Captured, 2nd time

R = Recaptured fish
(marked in 1st, recaptured in 2nd)

$$?N = \frac{M^{100} \times C^{100}}{R_{10}}$$

OR

$$N = \frac{\overset{71}{(M+1)}\,\overset{38}{(C+1)}}{\underset{7}{(R+1)}} =$$

Red = 280 $N = \frac{MC}{R}$ $M = 70$

1) Gloria $C = 37$, $R = 6$ so $N = \frac{70 \times 37}{6} = \cancel{432}$ 385

2) Roy $C = 42$, $R = 8$ so $N = \frac{70 \times 42}{8} = 377$

3) Virgil $C = 45$, $R = 7$ so $N = \frac{45 \times 70}{7} = 450$

4) $C = 36$, $R = 6$ so $N = \frac{36 \times 70}{6} = 420$

5)

Modified peterson

$$N = \frac{(M+1)(C+1)}{R+1}$$

$$V = \frac{(M+1)^2 (C+1)(C-R)}{(R+1)^2 (R+2)}$$

Escapement methods – Mark-recapture

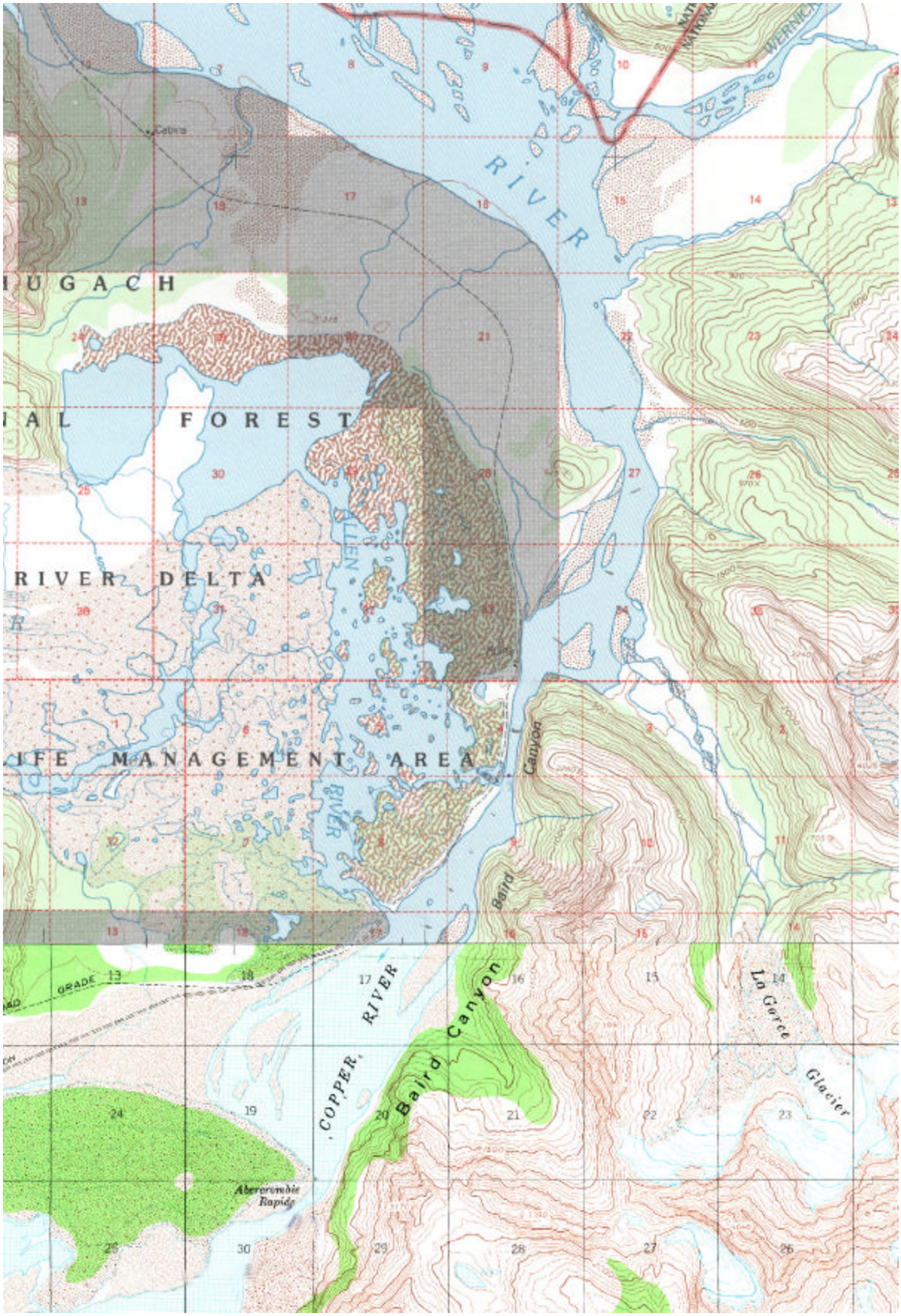
- **Pros**
  - **Low to moderate bias**
  - **Moderate precision**
  - **Good for answering ?????**
  - **Can use a bunch of different techniques**
- **Cons**
  - **Moderate to high $$$**
  - **Can be logistically difficult**
  - **Need to release fish unharmed**

Escapement methods – Mark-recapture

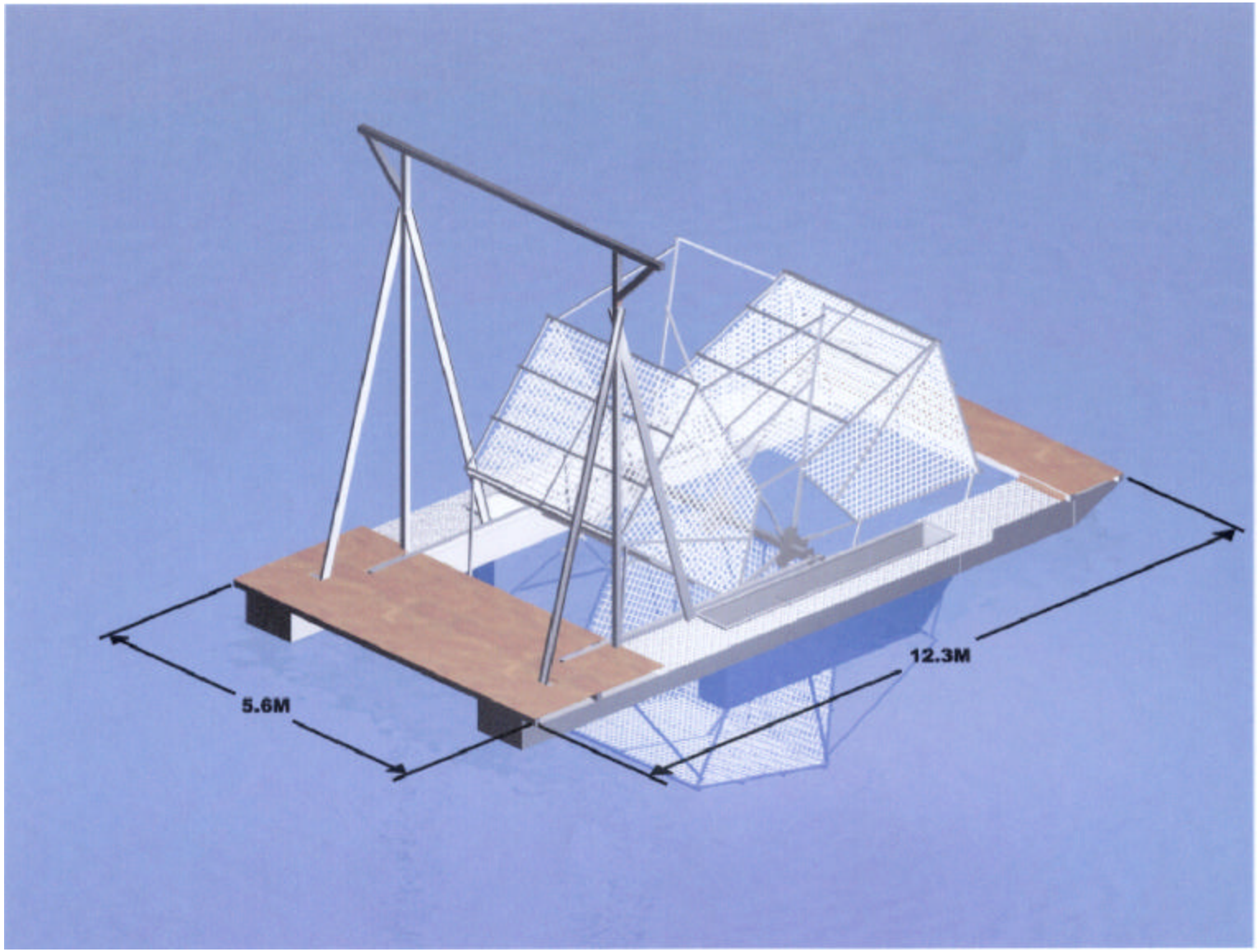
- **Pros**
  - **Low cost**
  - **Easy and fast**
- **Cons**
  - **High bias**
  - **Only good for small streams**
  - **Difficult to know *actual* numbers**

Copper River chinook

- Mark fish in Baird Canyon
- Recapture upstream (Wood Canyon?).



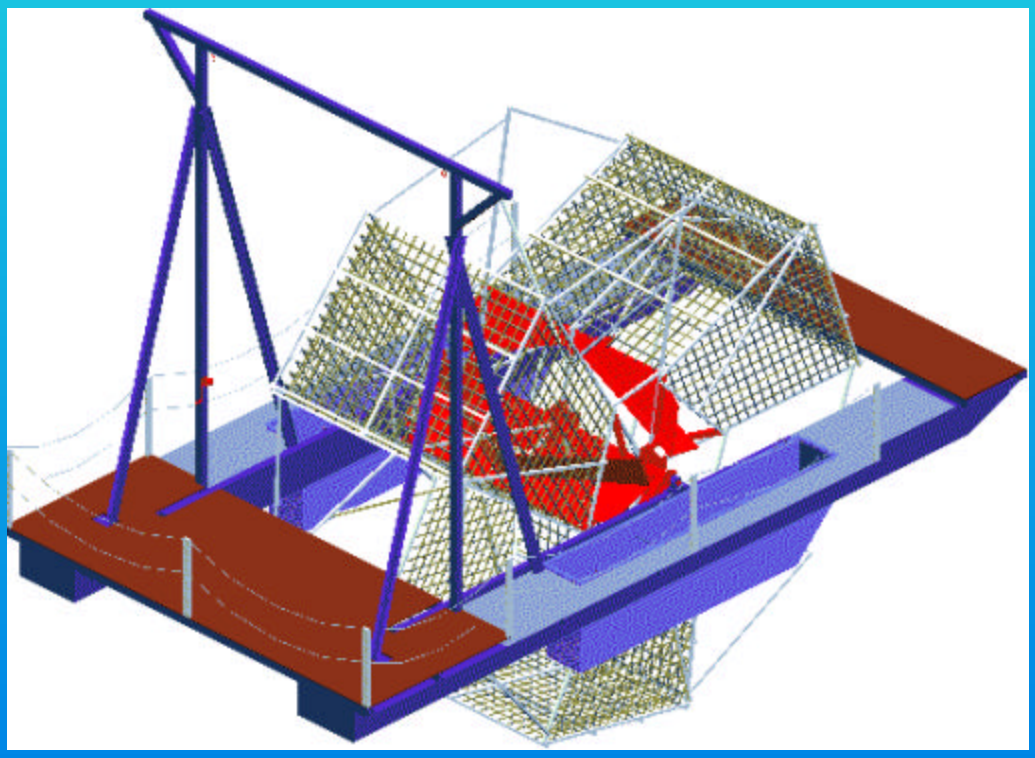
Map of Baird Canyon on lower Copper River.


5.6M
12.3M

Baird Canyon fishwheels

Baird Canyon fishwheels

Research fishwheels on Copper River



Copper River chinook - radio telemetry

- ADF&G project, 1999-?
- Mark fish in Wood Canyon
- Recapture upstream
- Learn abundance, distribution, and timing of chinook

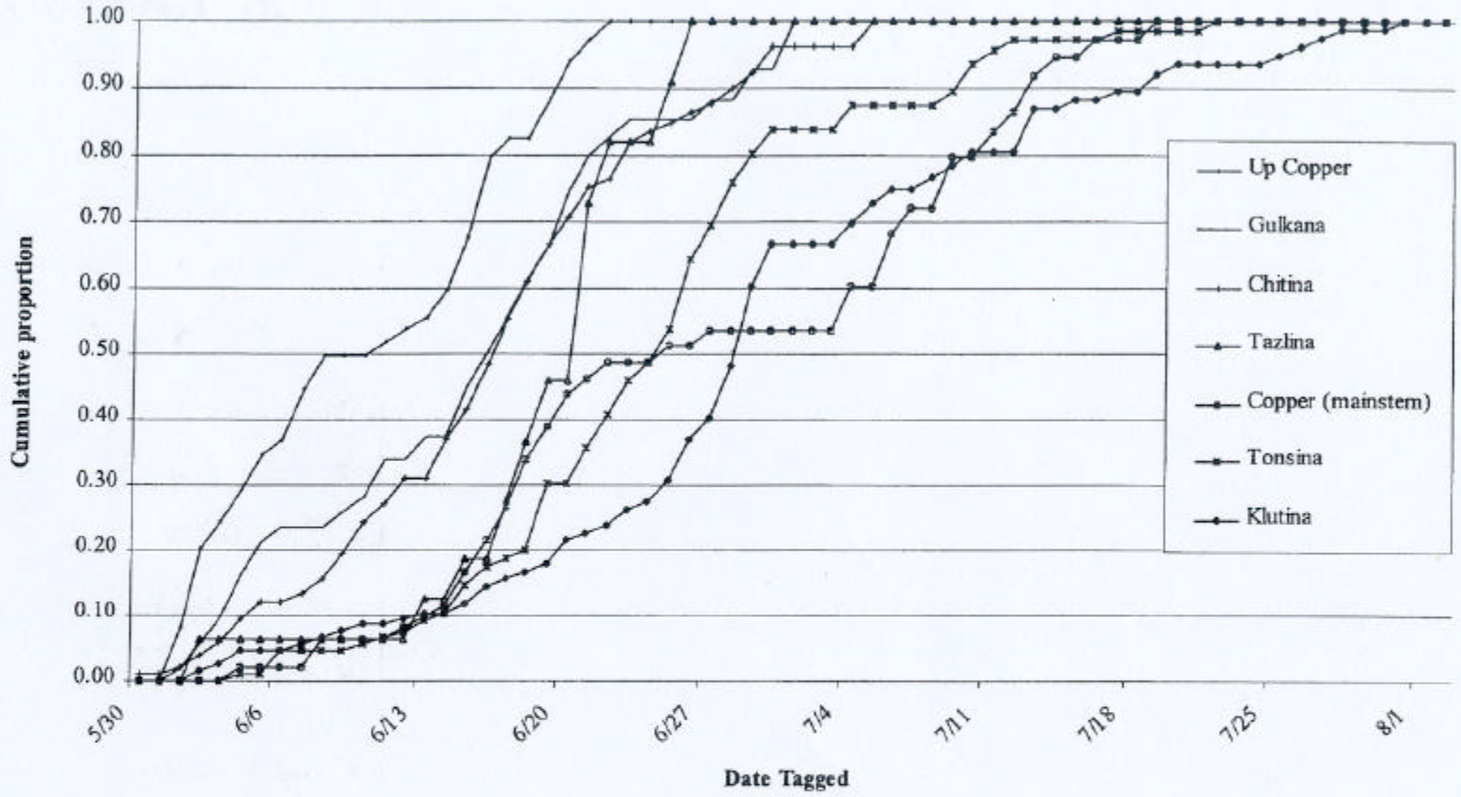


Figure 8.-Migratory-timing profiles at the capture site for the major spawning stocks of chinook salmon in the Copper River, 1999.

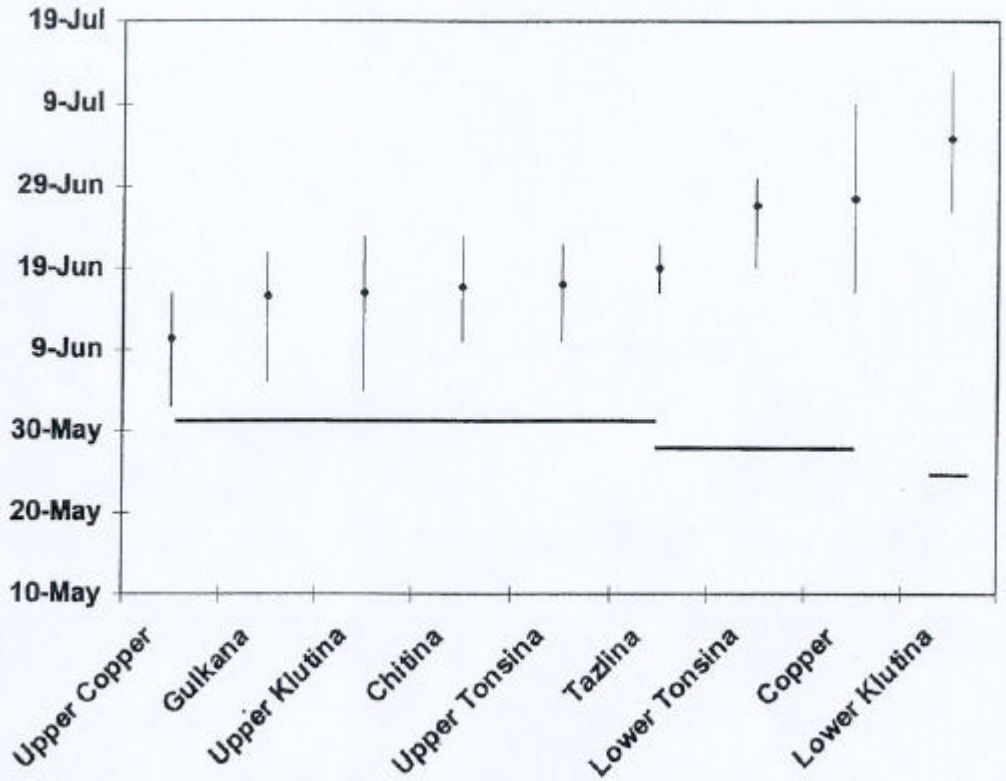


Figure 10.-Mean passage date (symbol) and 80% range (vertical lines) of Copper River chinook salmon stocks at the capture site in 1999. Horizontal lines indicate groups of stocks with similar mean passage dates.

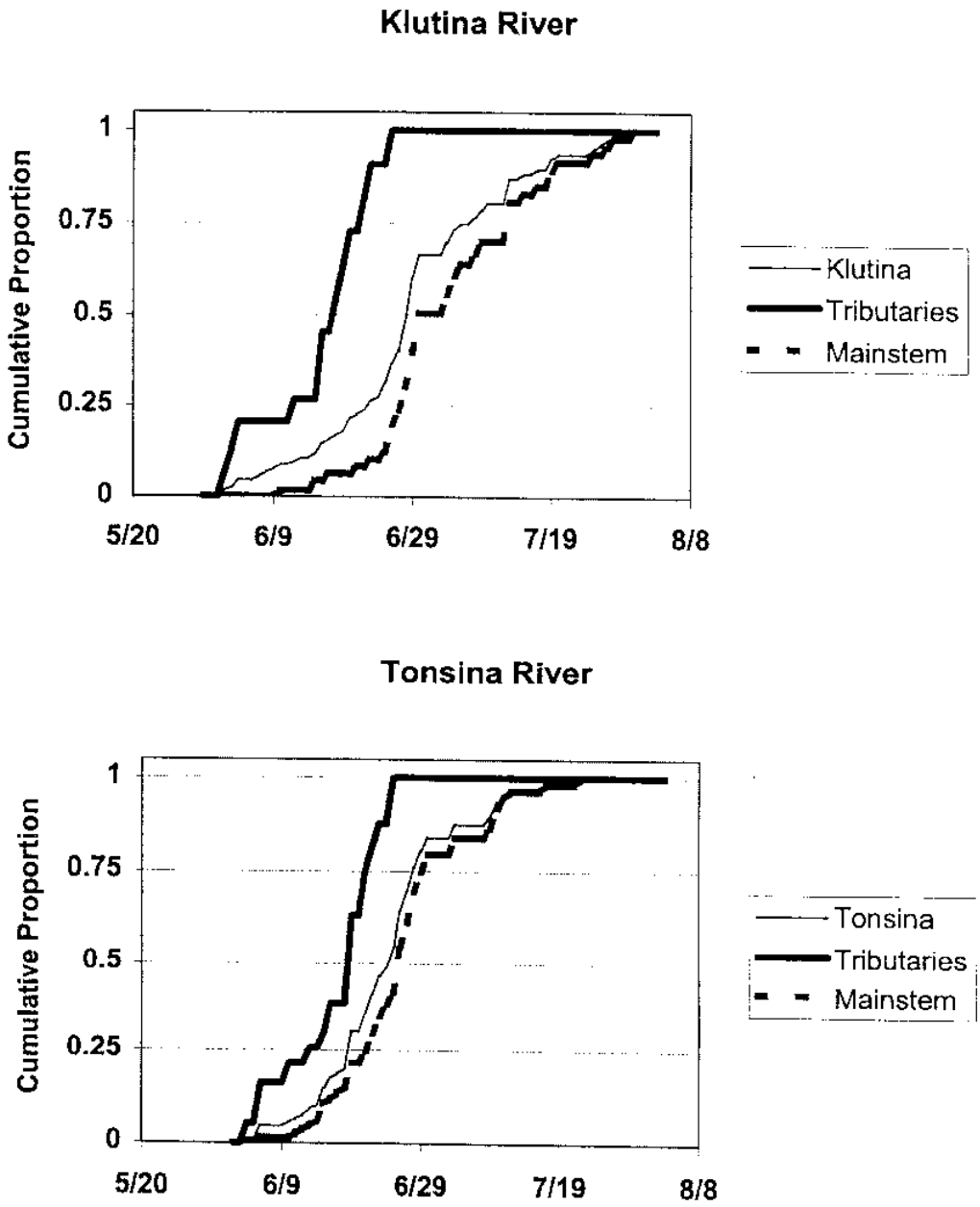


Figure 9.-Migratory-timing profiles of chinook salmon in the Klutina and Tonsina rivers comparing timing of tributary and mainstem spawners.

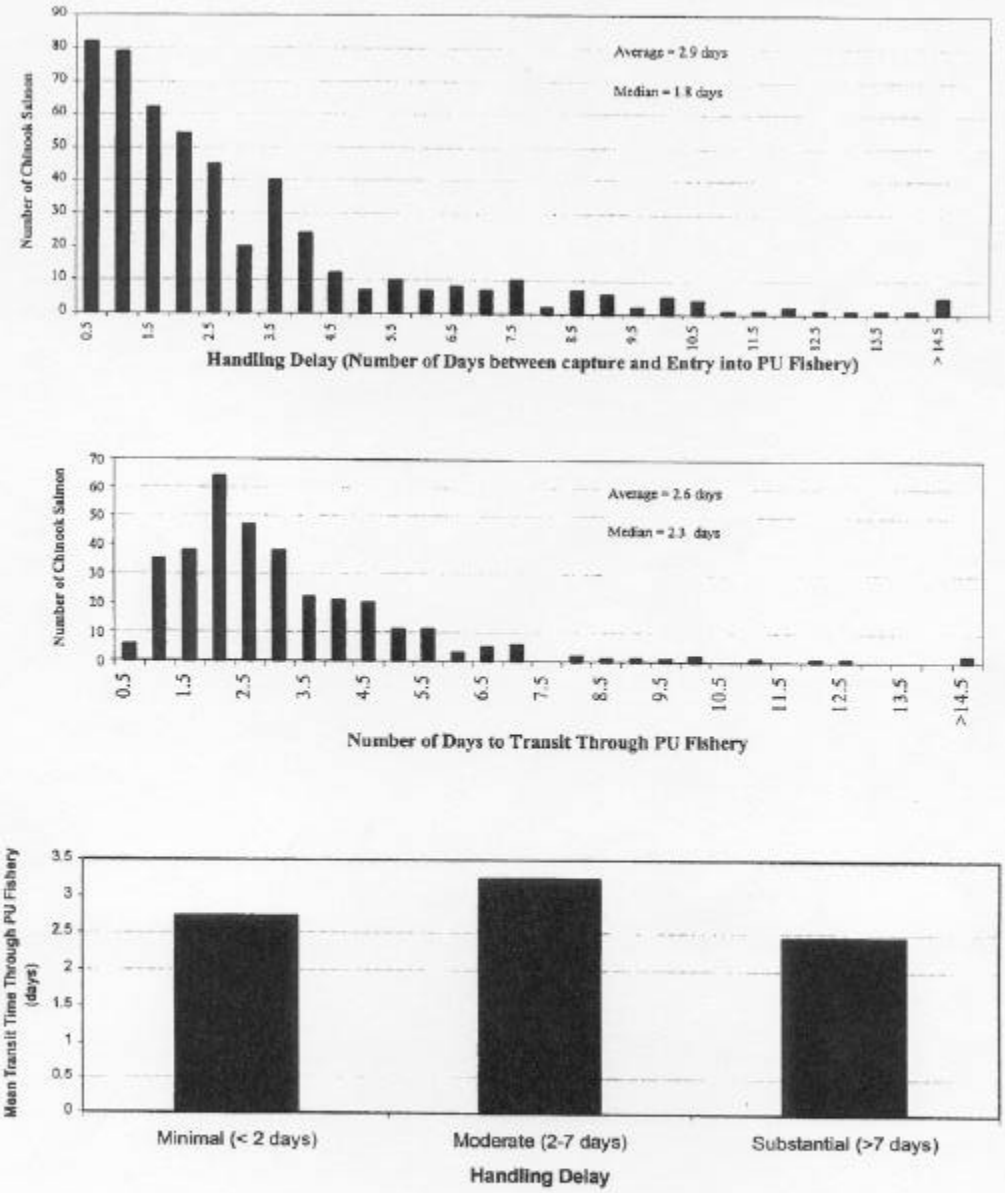


Figure 4.-Handling delay (top panel), transit times through the PU fishery (middle panel), and a comparison of mean transit times through the PU fishery of fish that exhibited minimal, moderate, and substantial handling delays (bottom panel) for radio-tagged chinook salmon in the Copper River, 1999.

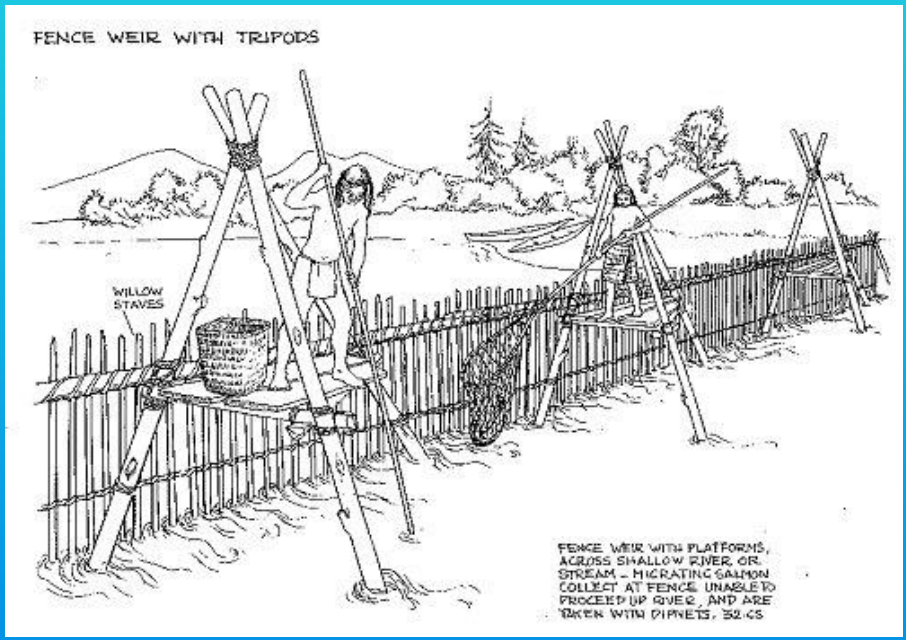
Escapement methods - Weirs

- Barriers that allow water to flow down, but block fish from moving up
- Can be used for fish ascending upstream, or descending downstream from lakes
- Can be used simply to count, or also to collect biological info

Escapement methods - Weirs

- **Pros**
  - **Low bias**
  - **Very repeatable (good precision)**
  - **Great for answering ?????**
- **Cons**
  - **High $$$**
  - **Limited to small systems or favorable flows**
  - **Can be difficult!**

Subsistence weir from British Columbia



Upper Copper weir – Tanada Creek

- NPS (WRST)
  - Summer Operation
  - Yields information on abundance and run timing
  - Kings and reds
  - Documented low run in 2001

Indexing – aerial surveys

- Fly at same time each year
- Allows us to compare from year to year
- Tells us *relative* difference in numbers from year to year, or among streams

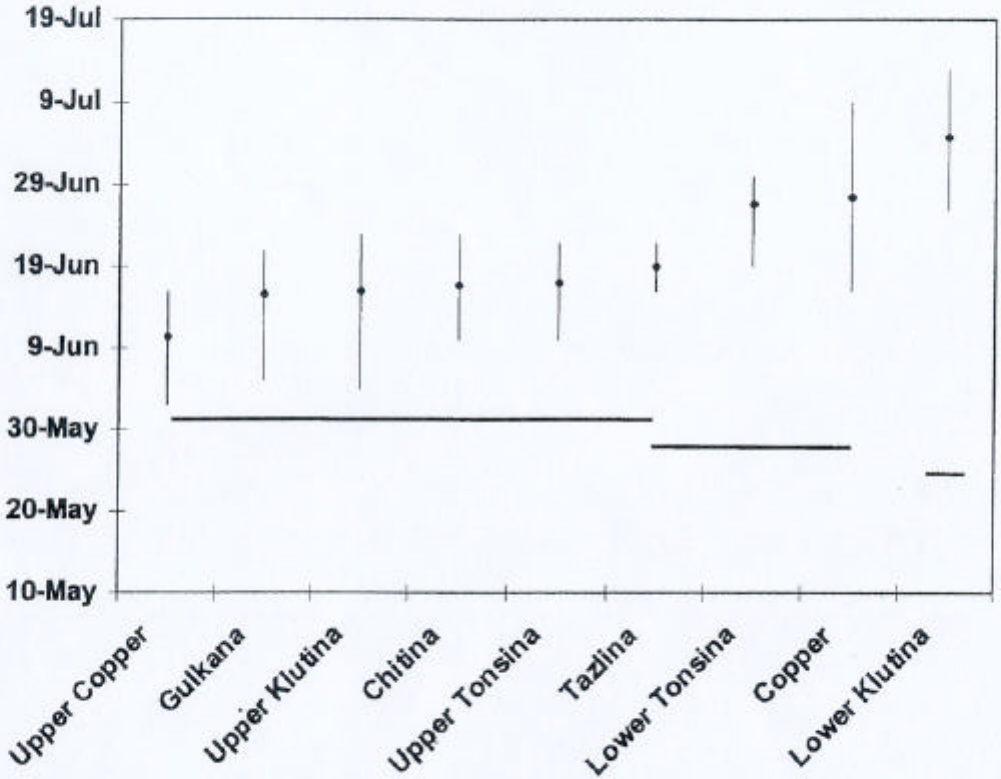
Aerial surveys on Copper River

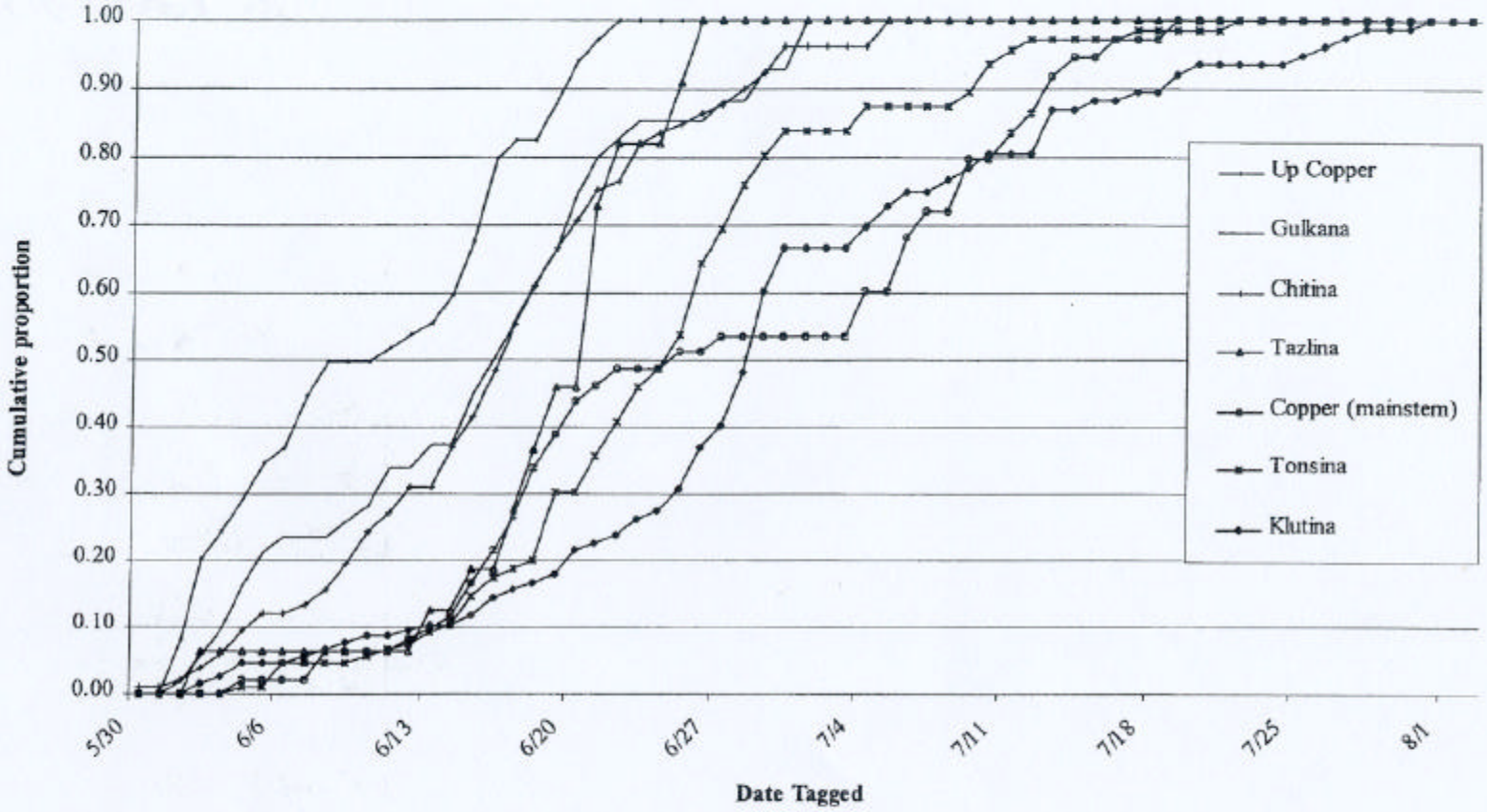
- Approximately 200 streams in PWS surveyed annually
- Long database
- Enough extra information gathered over time that it *can* estimate actual numbers
- Best way to estimate in PWS, where 1M+ fish return to 1,000+ streams

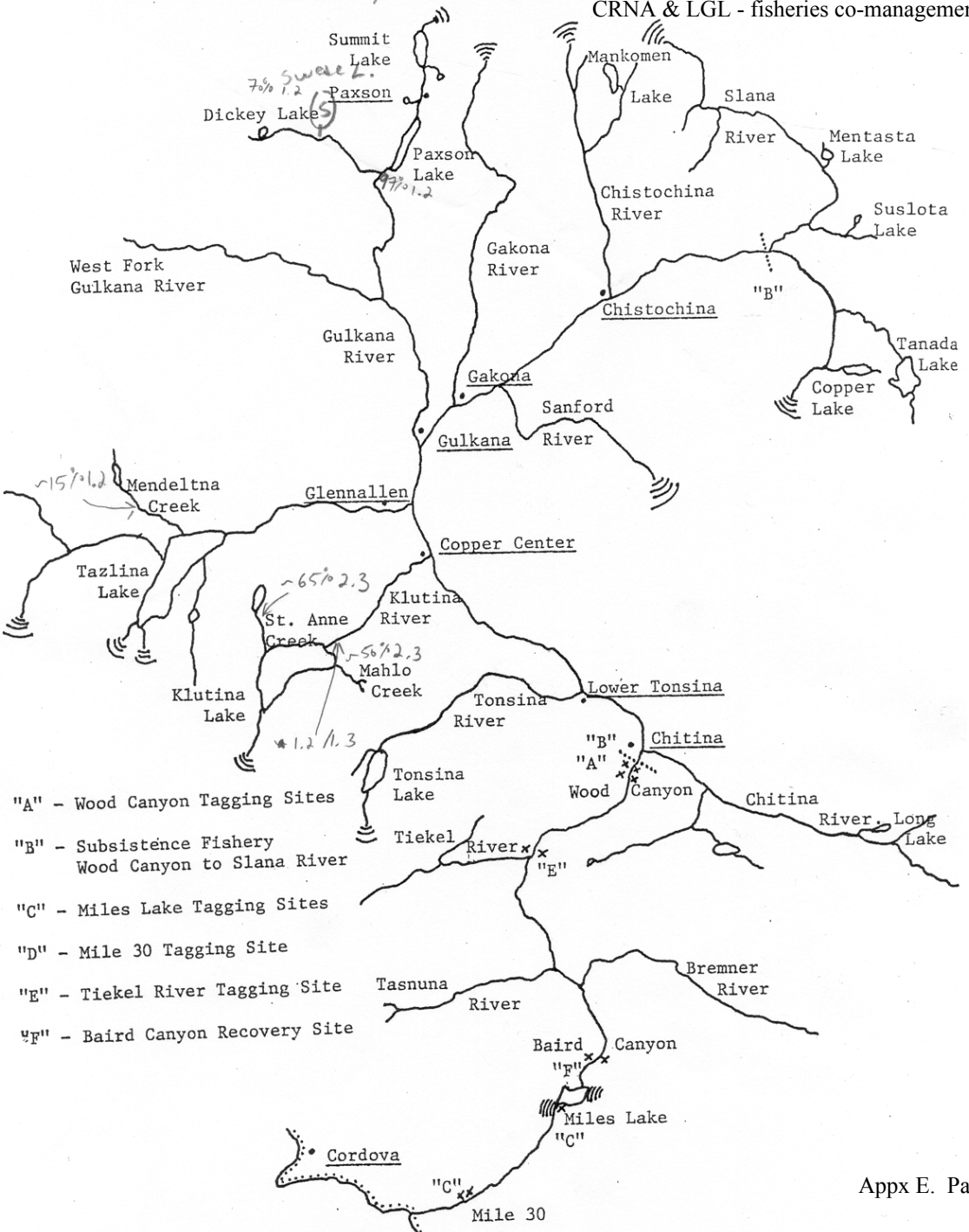
Copper River chinook - radio telemetry

- ADF&G project, 1999-?
- Mark fish in Wood Canyon
- Recapture upstream
- Learn abundance, distribution, and timing of chinook

Appendix E - Visuals for Module IV, Use and importance of stock assessment information for salmon management


19-Jul
9-Jul
29-Jun
19-Jun
9-Jun
30-May
20-May
10-May
Upper Copper
Gulkana
Upper Klutina
Chitina
Upper Tonsina
Tazlina
Lower Tonsina
Copper
Lower Klutina


1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Cumulative proportion
5/30
6/6
6/13
6/20
6/27
7/4
7/11
7/18
7/25
8/1
Date Tagged
Up Copper
Gulkana
Chitina
Tazlina
Copper (mainstem)
Tonsina
Klutina



"A" - Wood Canyon Tagging Sites

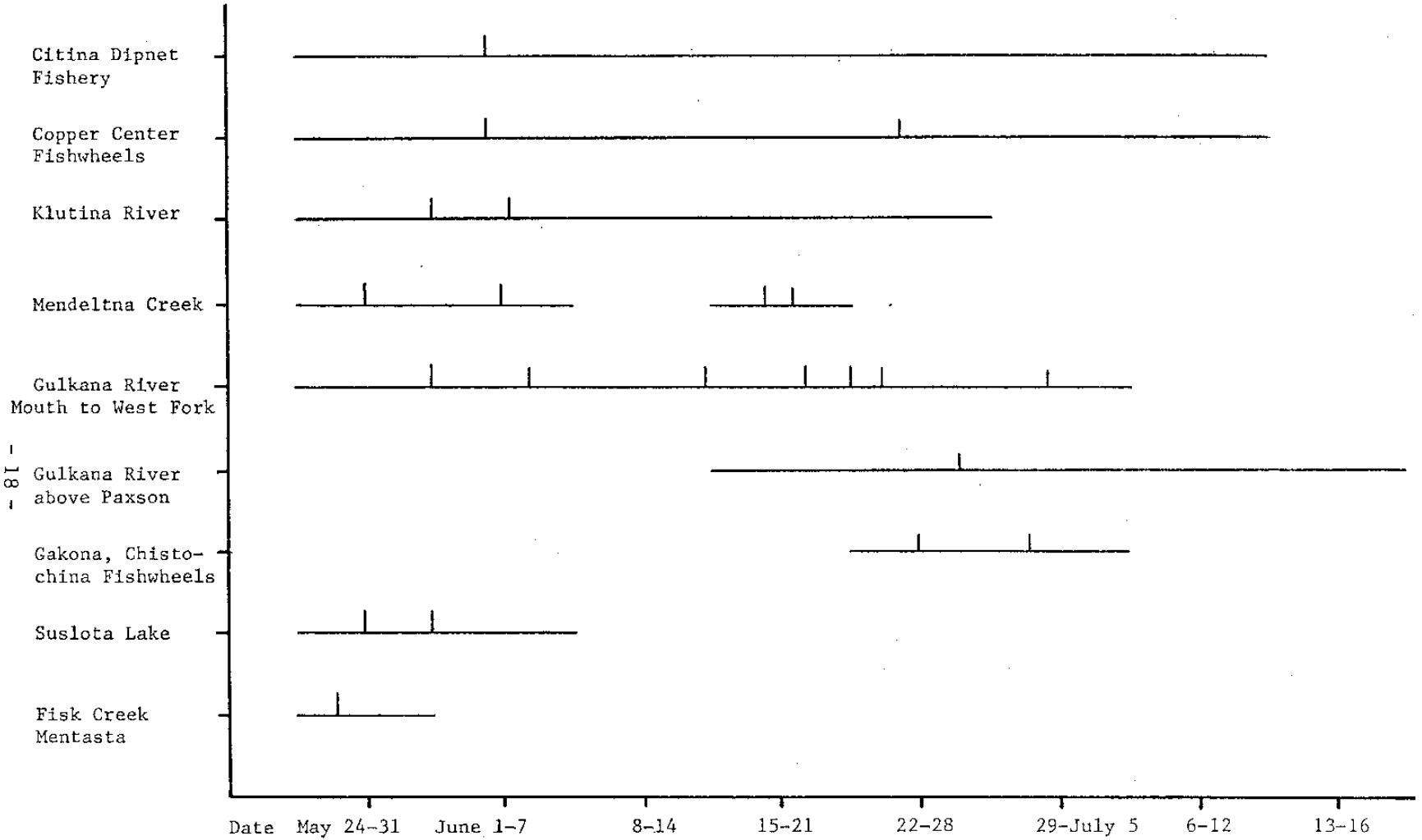
"B" - Subsistence Fishery Wood Canyon to Slana River

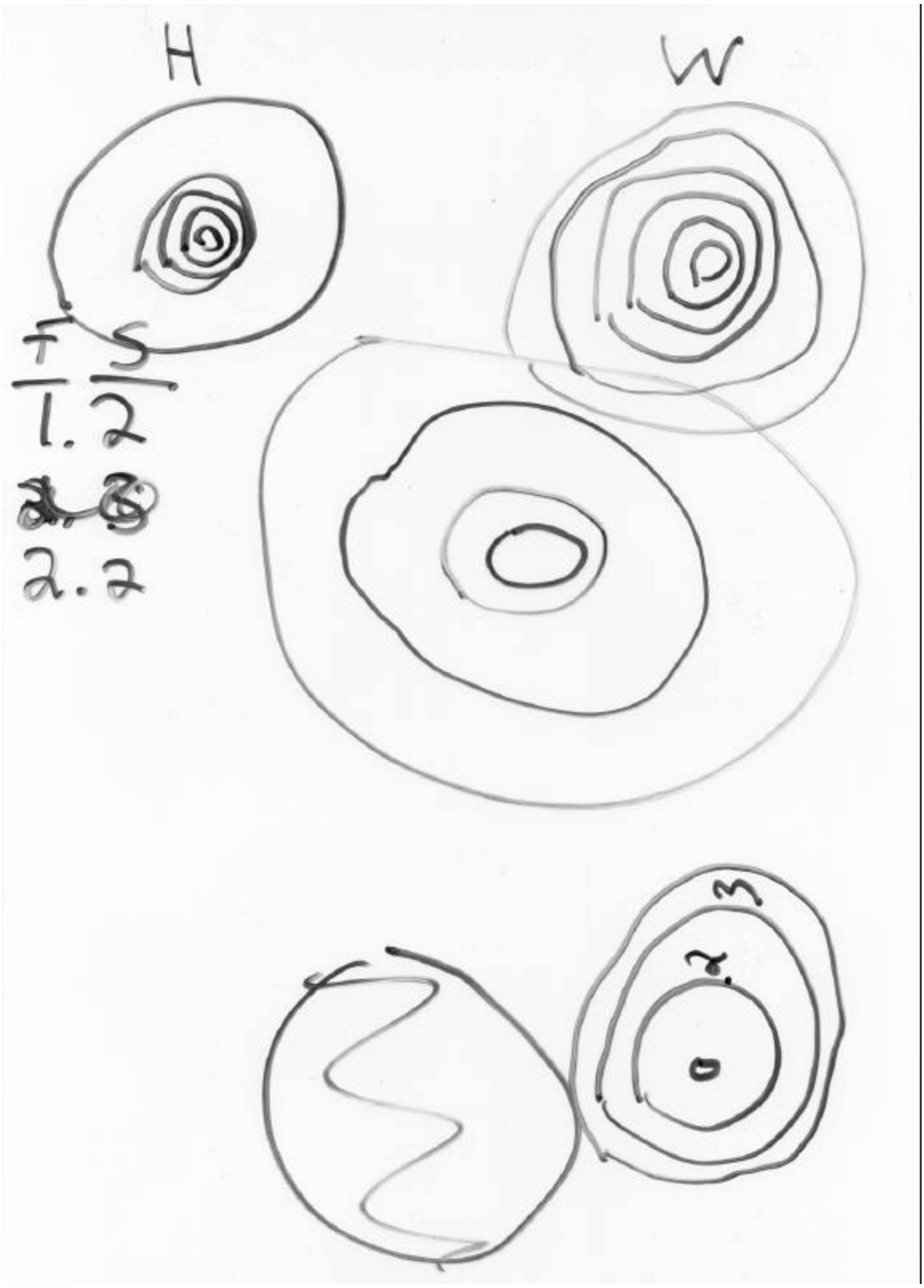
"C" - Miles Lake Tagging Sites

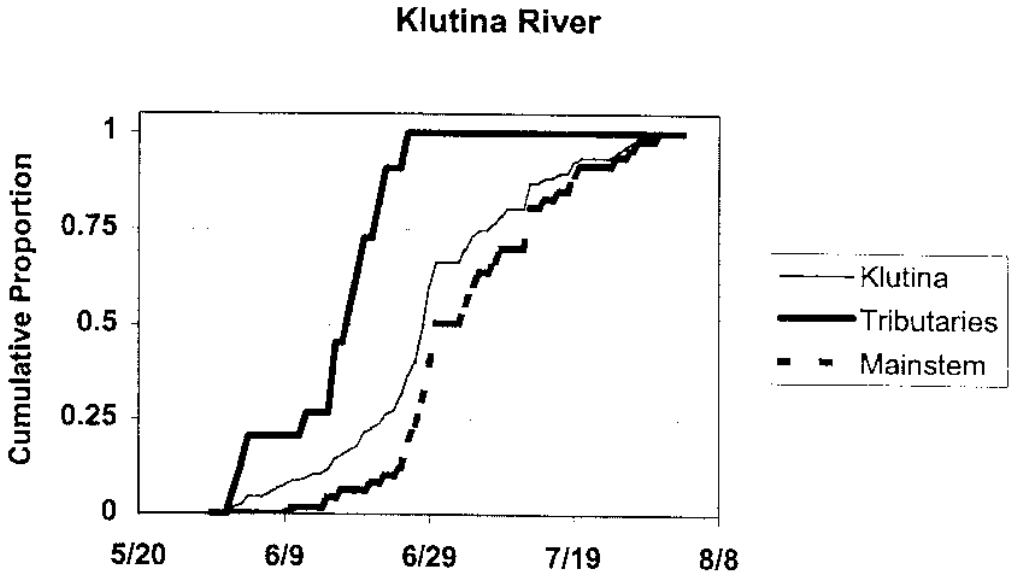
"D" - Mile 30 Tagging Site

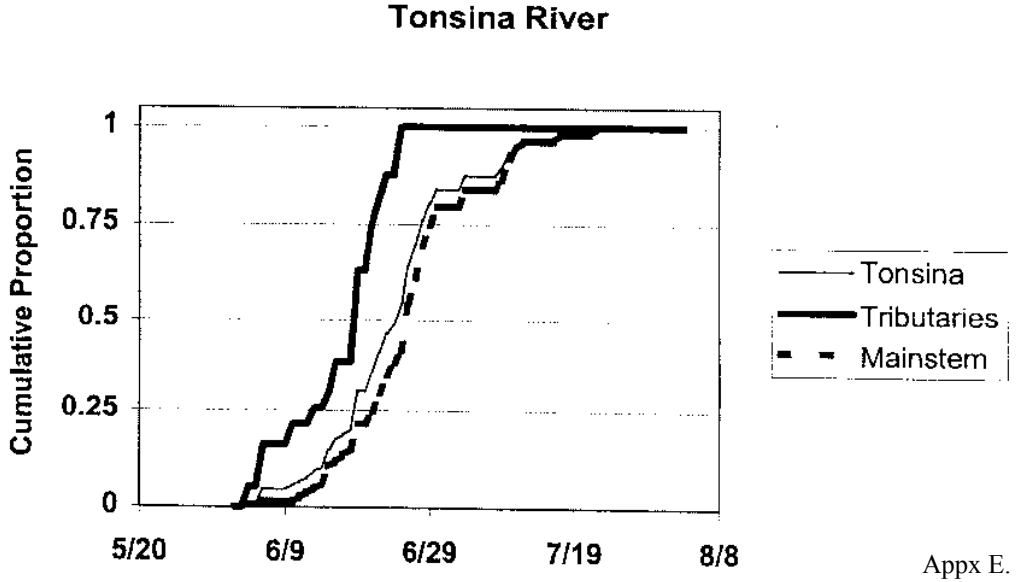
"E" - Tiekel River Tagging Site

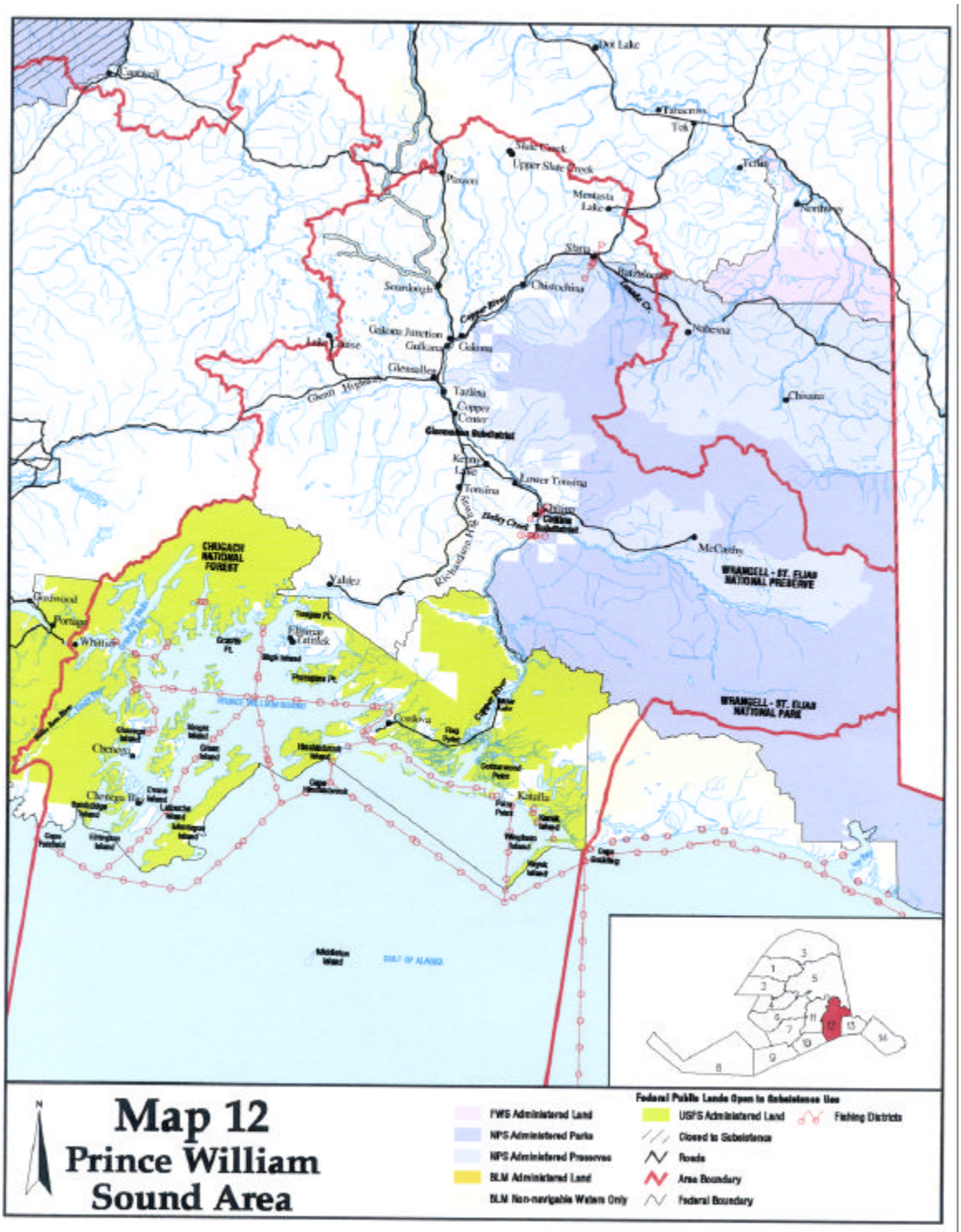
"F" - Baird Canyon Recovery Site

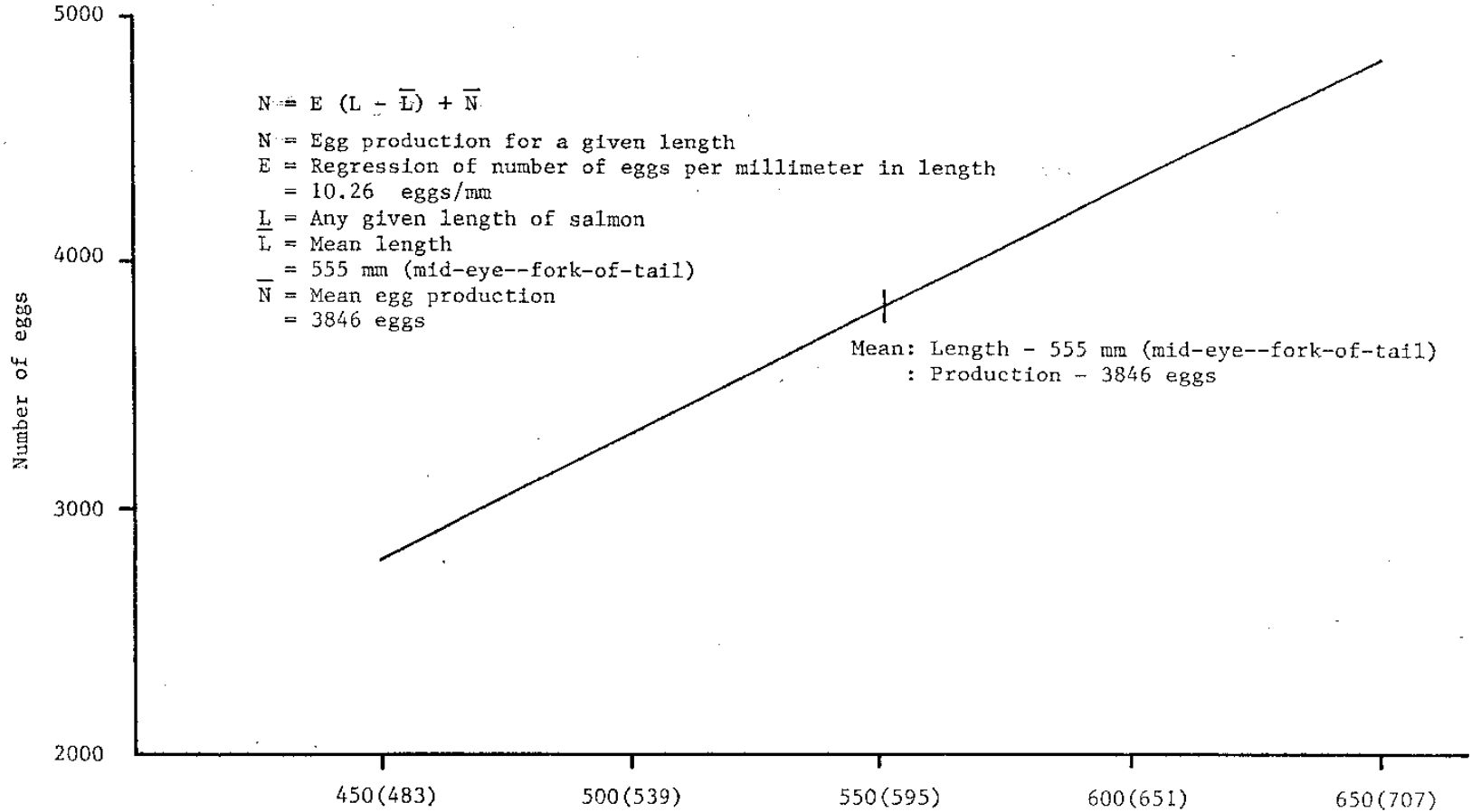

Citina Dipnet Fishery
Copper Center Fishwheels
Klutina River
Mendeltna Creek
Gulkana River Mouth to West Fork
Gulkana River above Paxson
Gakona, Chistochina Fishwheels
Suslota Lake
Fisk Creek Mentasta
Date
May 24-31
June 1-7
8-14
15-21
22-28
29-July 5
6-12
13-16


H
W
F
S
1.2
2.2
3
2
0

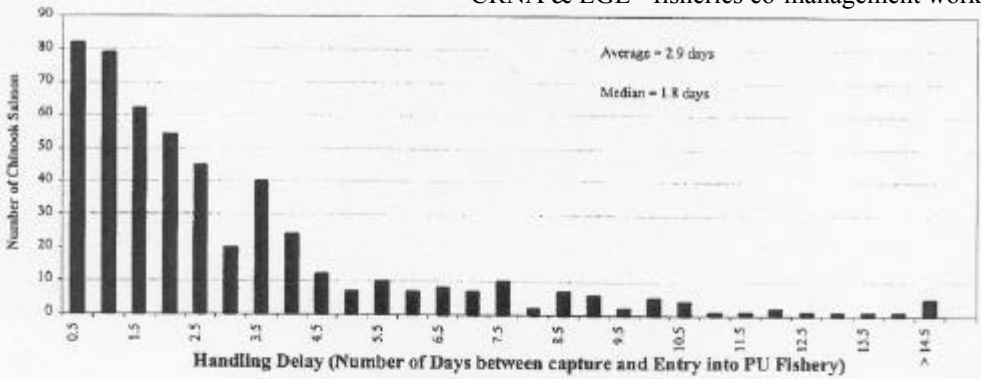

Klutina River
Cumulative Proportion
1
0.75
0.5
0.25
0
5/20
6/9
6/29
7/19
8/8
Klutina
Tributaries
Mainstem

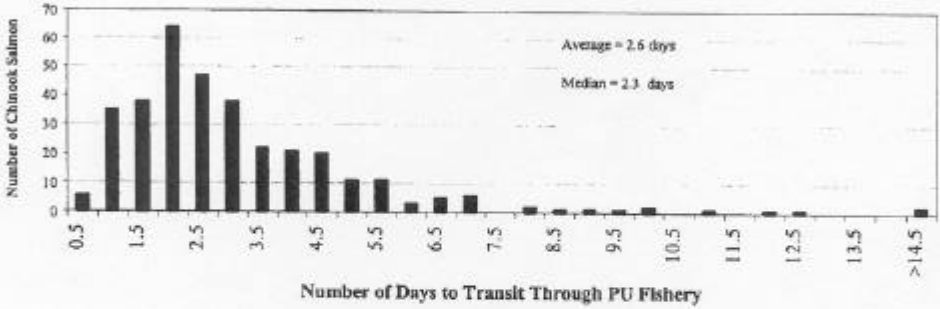

Tonsina River
Cumulative Proportion
1
0.75
0.5
0.25
0
5/20
6/9
6/29
7/19
8/8
Tonsina
Tributaries
Mainstem

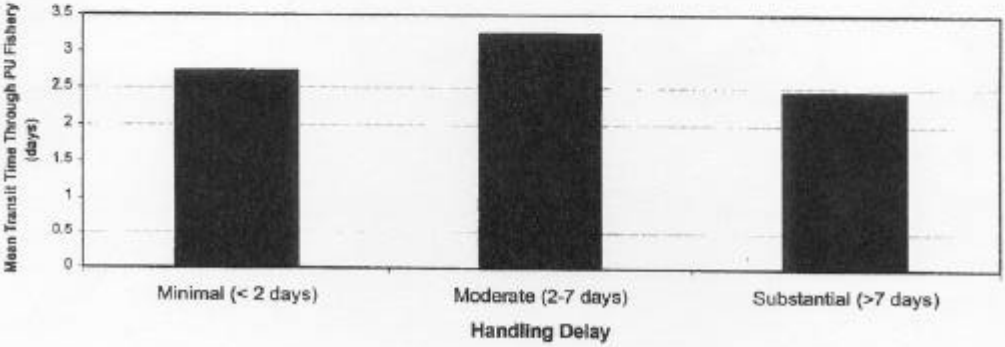

Map 12
Prince William Sound Area
FWS Administered Land
NPS Administered Parks
NPS Administered Preserves
BLM Administered Land
BLM Non-navigable Waters Only
Federal Public Lands Open to Subsistence Use
USFS Administered Land
Closed to Subsistence
Roads
Area Boundary
Federal Boundary
Fishing Districts
CHUGACH NATIONAL FOREST
WRANGELL - ST. ELIAS NATIONAL PRESERVE
WRANGELL - ST. ELIAS NATIONAL PARK
Valdez
Cordova
Whittier
Cheney Lake
Tonsina
Lower Tonsina
Copper Center
Glennallen
Gulkana
Gakona Junction
Sourdough
Paxson
Slate Creek
Upper Slate Creek
Mentasta Lake
Tok
Tetlin
Northway
Nabesna
Chistochina
Slana
Chisana
McCarthy
Kennicott
Kotzebue
Cape Gulkana
GULF OF ALASKA

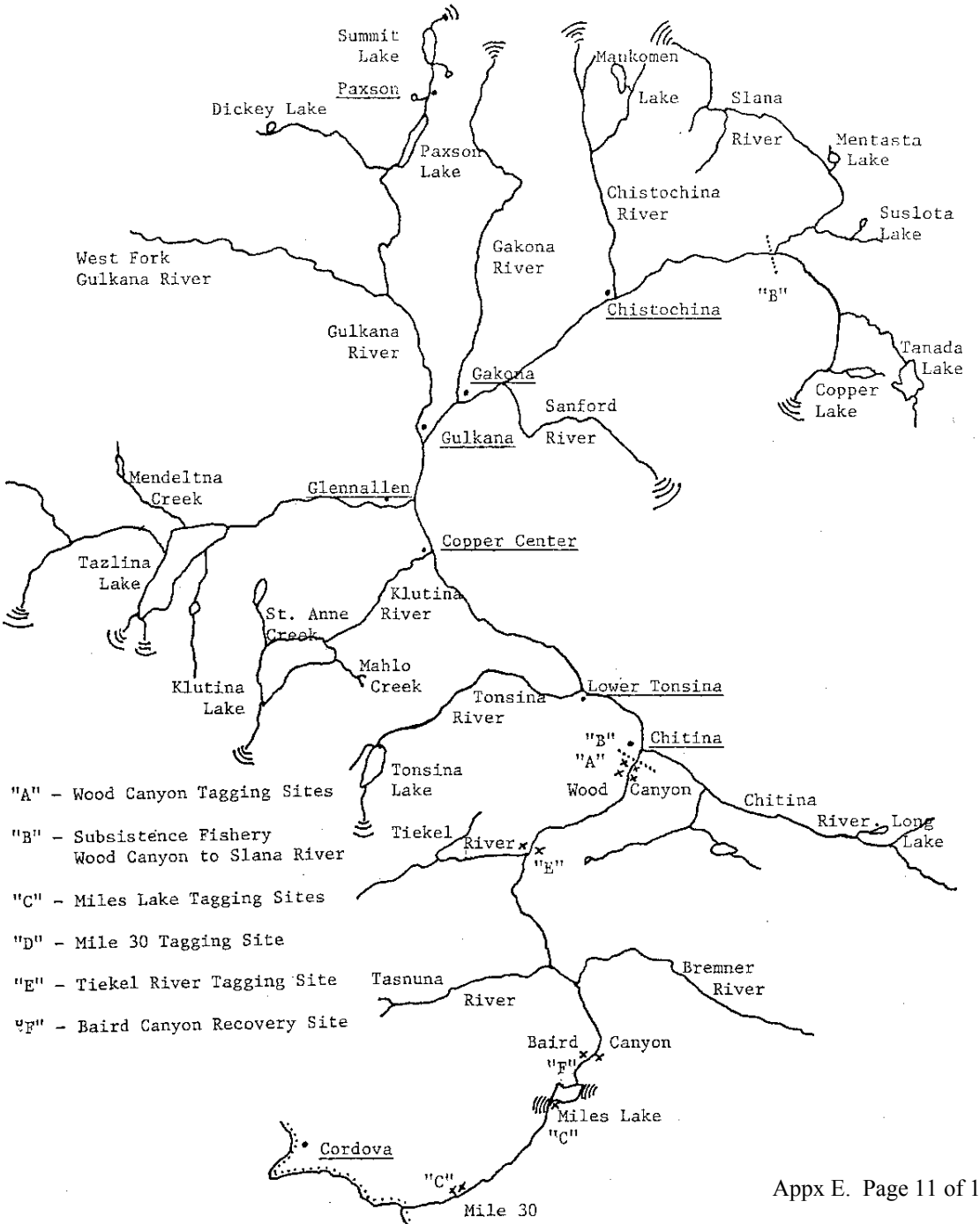

5000
4000
3000
2000
Number of eggs
N = E (L - L̄) + N̄
N = Egg production for a given length
E = Regression of number of eggs per millimeter in length
= 10.26 eggs/mm
L = Any given length of salmon
L̄ = Mean length
= 555 mm (mid-eye--fork-of-tail)
N̄ = Mean egg production
= 3846 eggs
Mean: Length - 555 mm (mid-eye--fork-of-tail)
: Production - 3846 eggs
450(483)
500(539)
550(595)
600(651)
650(707)

1) Baird Canyon FW
2) ADFG King tagging
3) ADFG Steelhead - Dickey & Han.
4) Tanada creek weir
5) Miles Lake Sonar
6) Steelhead Harvest CRNA NPS
7) Gulkana Tower
8) Resident TEK
9) ADFG bioSampling from fishery
10) ADFG Coded wire tag
11) Long lake Weir
12) ADFG aerial surveys


Average = 2.9 days
Median = 1.8 days
Number of Chinook Salmon
Handling Delay (Number of Days between capture and Entry into PU Fishery)


Average = 2.6 days
Median = 2.3 days
Number of Chinook Salmon
Number of Days to Transit Through PU Fishery


Mean Transit Time Through PU Fishery (days)
Minimal (< 2 days)
Moderate (2-7 days)
Substantial (>7 days)
Handling Delay


Summit Lake
Paxson
Dickey Lake
Paxson Lake
Maukomen Lake
Slana River
Mentasta Lake
Chistochina River
Suslota Lake
West Fork Gulkana River
Gakona River
"B"
Chistochina
Gulkana River
Tanada Lake
Gakona
Copper Lake
Sanford River
Gulkana
Mendeltna Creek
Glennallen
Copper Center
Tazlina Lake
Klutina River
St. Anne Creek
Mahlo Creek
Klutina Lake
Lower Tonsina
Tonsina River
"B"
Chitina
"A"
Wood Canyon
Tonsina Lake
Chitina River
Long Lake
Tiekel River
"E"
Tasnuna River
Bremner River
Baird Canyon
"F"
Miles Lake
"C"
Cordova
"C"
Mile 30
"A" - Wood Canyon Tagging Sites
"B" - Subsistence Fishery Wood Canyon to Slana River
"C" - Miles Lake Tagging Sites
"D" - Mile 30 Tagging Site
"E" - Tiekel River Tagging Site
"F" - Baird Canyon Recovery Site

Appendix F - Attendee list for Workshop I

Appendix F

Attendee list for Workshop 1, held April 11-12, 2002 in Tazlina, Alaska.

April 11
Gloria Stickwan – CRNA and subsistence representative
Roy Tansy, Jr. – Subsistence representative
John Goodlataw – Subsistence representative
Virginia Gene – Subsistence representative
Matt Nemeth – LGL (presenter)
Dave Nelson – National Park Service (presenter)
Bill Simeone – Alaska Department of Fish and Game (presenter)
Tom Taube – Alaska Department of Fish and Game
Sandra Scott – National Park Service
Devi Sharp – National Park Service

April 12
Gloria Stickwan
Roy Tansy, Jr.
John Goodlataw
Virginia Gene
Matt Nemeth (presenter)
Bill Simeone (presenter)
Dave Sarafin – Alaska Department of Fish and Game (presenter)

Appendix G - Itinerary for Workshop II - onsite projects visit in Cordova, Alaska, July 30-August 2, 2002

Appendix G

Itinerary for Workshop II - onsite projects visit in Cordova, Alaska, July 30-August 2, 2002

Hosted by ADF&G
Funded by U.S. Fish and Wildlife Service – Office of Subsistence Management
Contacts: Gloria Stickwan (CRNA), Matt Nemeth (LGL)

AGENDA

July 30, 2002
11:45 pm - Ferry departure from Valdez.

July 31, 2002
5:30 am - Ferry arrival in Cordova.
11:00 am – NVE staff to learn about Copper River fishwheel project.
1:00 pm – Depart Cordova for Mile Lake.
Afternoon – tour Miles Lake sonar station with ADF&G field crew.

August 1, 2002
9:00 am – Tour Prince William Sound Science Center with Nancy Bird.
1:00 pm – Tour of Prince William Sound fishing vessels with Gary McCune.
3:00 pm – Tour Ocean Beauty processing plant.
Evening – Dinner with NVE

August 2, 2002
Day open
Morning - Potential trip to Baird Canyon fishwheels with NVE.
Evening – Return to Valdez via ferry or airplane (courtsey of NVE).