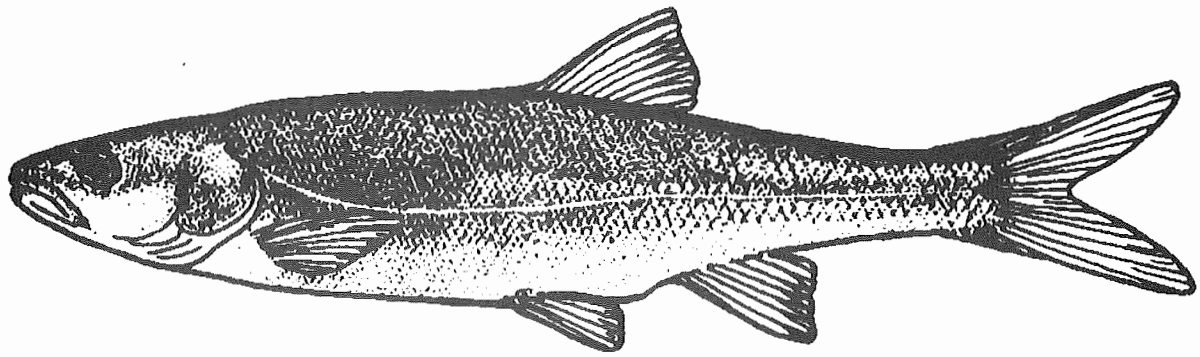
(Draft) Squawfish Management Program

Environmental Assessment



Squawfish

"Ptychocheilus oregonensis"

Bonneville
POWER ADMINISTRATION

May 1991

DRAFT

ENVIRONMENTAL ASSESSMENT

SQUAWFISH MANAGEMENT PROGRAM

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EXECUTIVE SUMMARY FOR THE ENVIRONMENTAL ASSESSMENT FOR THE SQUAWFISH MANAGEMENT PROGRAM

Purpose. Bonneville Power Administration (BPA) proposes to decrease the number of northern squawfish (Ptychocheilus oregonensis) in reservoirs in the Columbia River system through a Squawfish Management Program. The goal of the Squawfish Management Program is to reduce losses of outmigrating juvenile salmon and steelhead (salmonids) to squawfish predation. The objective is to reduce the number of squawfish that feed on juvenile salmonids (smolts) by 10 to 20 percent and alter the age and size structure of the squawfish population. The hypothesis, based on computer modeling, indicates sustained squawfish harvest and the resultant population restructuring may reduce losses of juvenile salmonids to predation by up to 50 percent within 5 to 10 years.

Proposal. BPA proposes to fund three types of fisheries to harvest squawfish. BPA also proposes to fund monitoring activities of these fisheries to determine if desired or undesirable results occur.

The three fisheries proposed are: (1) commercial Tribal fishing; (2) sport reward fishing; and (3) fishing from restricted areas of each dam (i.e., dam angling). These fisheries were tested successfully in 1990. Commercial fishing would be implemented by Tribal anglers in the area of the Columbia River from Bonneville Dam to McNary Dam. Sport reward fishing would be open to all anglers and encouraged through a reward for each squawfish caught. Dam angling would be carried out by technicians hired by the States or Tribes to fish for squawfish from restricted areas on the dams. Additional efforts to harvest squawfish from the restricted zones around dams may also be undertaken by State and Federal fishery agencies and Tribes.

In 1991 BPA proposes to fund squawfish management activities throughout the Federal hydrosystem on the lower Columbia and Snake Rivers from below Bonneville Dam to Priest Rapids Dam on the lower Columbia River, and from the mouth of the Snake River up to Lower Granite Reservoir. In the future, regional entities may plan squawfish management in the Columbia River from Priest Rapids Dam to Chief Joseph Dam. Expanding the program would be dependent on funding, access for fishing from restricted areas on non-Federal dams, and results of initial squawfish management efforts.

Monitoring will include evaluating how populations of squawfish and other predators respond to harvest, studying how juvenile salmonids are selected as prey, and developing and testing ways to remove predators and protect juvenile salmonids from predators. Ultimately, juvenile fish survival and adult production would be the basis to determine success of the program.

The Squawfish Management Program is designed to reduce the effects of predation by squawfish on juvenile anadromous fish migrating to the ocean. Juvenile anadromous fish migrate through existing reservoirs and dams on the Columbia and Snake Rivers. Many juvenile salmonids are lost to predators. The northern squawfish is the predominant predator of juvenile salmonids. Reducing the number of squawfish in the river system is intended to increase the survival of juveniles and thus increase the number of adults returning from the ocean to spawn.

Environmental Issues

The following concerns are analyzed in the Environmental Assessment (EA).

- Incidental Catch. In tests of the proposed fisheries, low numbers of other fish were caught through incidental catch, with no significant injury or mortality to incidentally caught fish.

- Intraspecific Concerns. Once squawfish are removed, the remaining squawfish population could overcompensate for reduced numbers of large squawfish. Consumption rates and growth of remaining squawfish could increase if squawfish numbers are reduced. If removing squawfish is not sustained, predation may be aggravated if removal restructures the population and increases the number or size of squawfish. Monitoring and evaluation is planned to determine the effects of squawfish harvest on squawfish population dynamics.

- Interspecific Concerns. In complex natural communities, reducing the numbers of one predator may cause other predators to grow faster in size or increase in number. Interaction among predator fish species in the community could reduce the benefits anticipated from predator control. Interactions occurring among predators are not well understood. One of the purposes of the monitoring and evaluation associated with this program is to gather data on how squawfish and other predators respond to the program, delineate these potentials for change, and adjust the program to the predators' response.

- Recreation. Squawfish management is not expected to interfere with existing recreation activities on the water and at boat launch sites. During the 1990 test sport reward fishery, few conflicts at boat launch sites (e.g., congestion on ramps) or on the water occurred. Late in the summer, there is a potential for interaction between sport anglers, windsurfers, and jet- and water-skiers. Long-line commercial angling gear and sport fishing gear in some instances became entangled during the 1990 commercial fishery test. Setting fishing times, areas, and depths-of-sets for commercial anglers would separate commercial and sport anglers and minimize potential conflicts with recreation fisheries. Ongoing monitoring and evaluation will be conducted to direct management of this program and ensure that conflicts with these and other recreational activities are minimized.

- Biological Risk. There is generally regional agreement that there is little biological risk from harvesting squawfish. How squawfish and other species will compensate for squawfish removed is unknown, but population dynamics of these predator fishes is such that significant compensation is not anticipated. This program is intended to restore a more natural balance among juvenile salmonids and squawfish. Ongoing monitoring and evaluation will provide information to allow adaptive management of the program.

Conclusions

Any negative effects of the Squawfish Management Program, as summarized above, would be temporary and minor. Evaluation and monitoring is planned to determine how squawfish and other predators respond to the program. One of the purposes of gathering this information is to adjust the program to the predators' response. Squawfish management is intended to help restore a more natural balance among juvenile salmonids and squawfish. Implementation of this program will reduce the number of squawfish that feed on juvenile salmonids. As a consequence, there would be greater survival of juvenile salmonids and therefore, adult salmonids returning to the system. Based on the evaluation presented in the EA, there would be no significant adverse environmental impacts if the proposed action is implemented.

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CHAPTER 1

PROPOSAL AND BACKGROUND

1.1 DESCRIPTION OF PROPOSAL

Bonneville Power Administration (BPA) proposes to decrease the number of northern squawfish (Ptychocheilus oregonensis) in reservoirs in the Columbia River system through a Squawfish Management Program. The goal of this program is to reduce losses of outmigrating juvenile salmon and steelhead (salmonids) to squawfish predation. The objective is to reduce the number of squawfish that feed on juvenile salmonids (smolts) by 10 to 20 percent and alter the age and size structure of the squawfish population. The proposed action would target squawfish over 11 inches, the size in which squawfish begin preying significantly on juvenile salmonids.

The Squawfish Management Program is designed to reduce the effects of predation by squawfish on juvenile anadromous fish migrating to the ocean. Juvenile anadromous fish migrate through existing reservoirs and dams on the Columbia and Snake Rivers. Many juvenile salmonids are lost to predators. The northern squawfish is the predominant predator of juvenile salmonids. Reducing the number of squawfish in the river system is intended to increase the survival of juveniles and thus increase the number of adults returning from the ocean to spawn.

The hypothesis, based on computer modeling, indicates sustained squawfish harvest and the resulting population restructuring may reduce losses of juvenile salmonids to predation by up to 50 percent within 5 to 10 years. Significant increases in survival are necessary to attain an increase in the run of adult salmonids returning each year to spawn. Figure 1 shows the decrease in potential predation by squawfish.

BPA would harvest squawfish by funding three fisheries:

- Sport fishing for squawfish open to all appropriately licensed anglers and encouraged through a reward for each squawfish caught.
- Commercial fishing by Tribal anglers in Zone 6, the area of the Columbia River from Bonneville Dam to McNary Dam.
- Fishing from dams (dam angling) by technicians hired by fishery agencies and Tribes to fish for squawfish from restricted areas on the dams.

In addition to fishing, BPA proposes to: (1) monitor how populations of squawfish and other predator fishes respond to the squawfish fisheries; (2) continue research on how squawfish select smolts; (3) study how smolts can be protected from predators; and (4) develop and test other squawfish removal approaches.

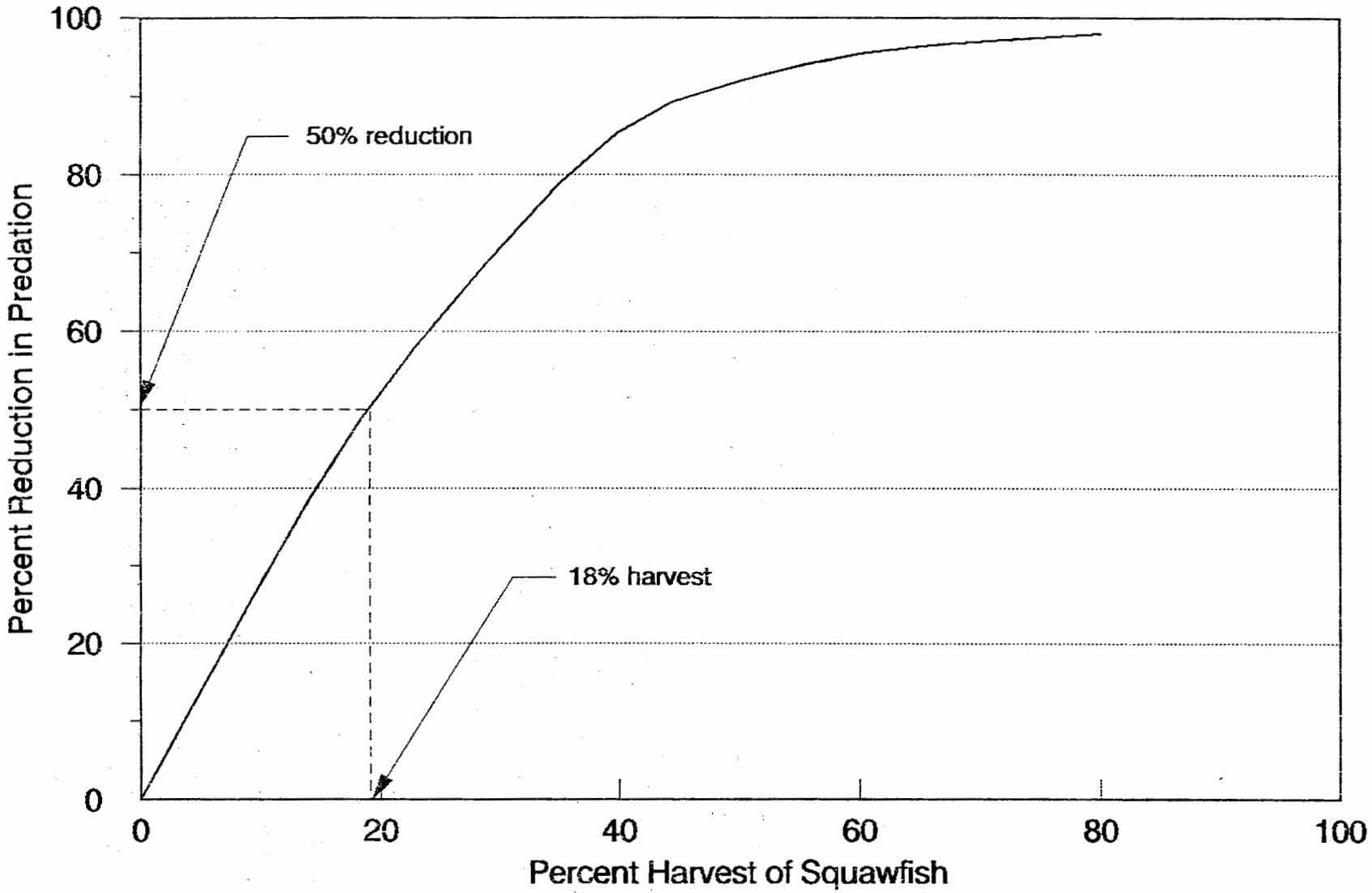


Figure 1. Potential reduction in predation resulting from Squawfish Management
(Adapted from Rieman and Beamesderfer 1988)

In 1991, the fisheries will be implemented from below Bonneville Dam to Priest Rapids Dam on the Columbia River, and from the mouth of the Snake River, up to Lower Granite Reservoir. In the future, the program may be expanded on the Columbia River from Priest Rapids Dam, through the non-Federal Mid-Columbia reservoirs, to Chief Joseph Dam; BPA does not plan to fund squawfish management in non-Federal reservoirs. Expanding the program would be dependent on funding, access for fishing from restricted areas of non-Federal dams, and results of the initial Squawfish Management Program. Figure 2 (Map of Reservoirs) shows locations of dams and reservoirs on the Columbia System.

1.2 NEED FOR THE PROPOSED ACTION

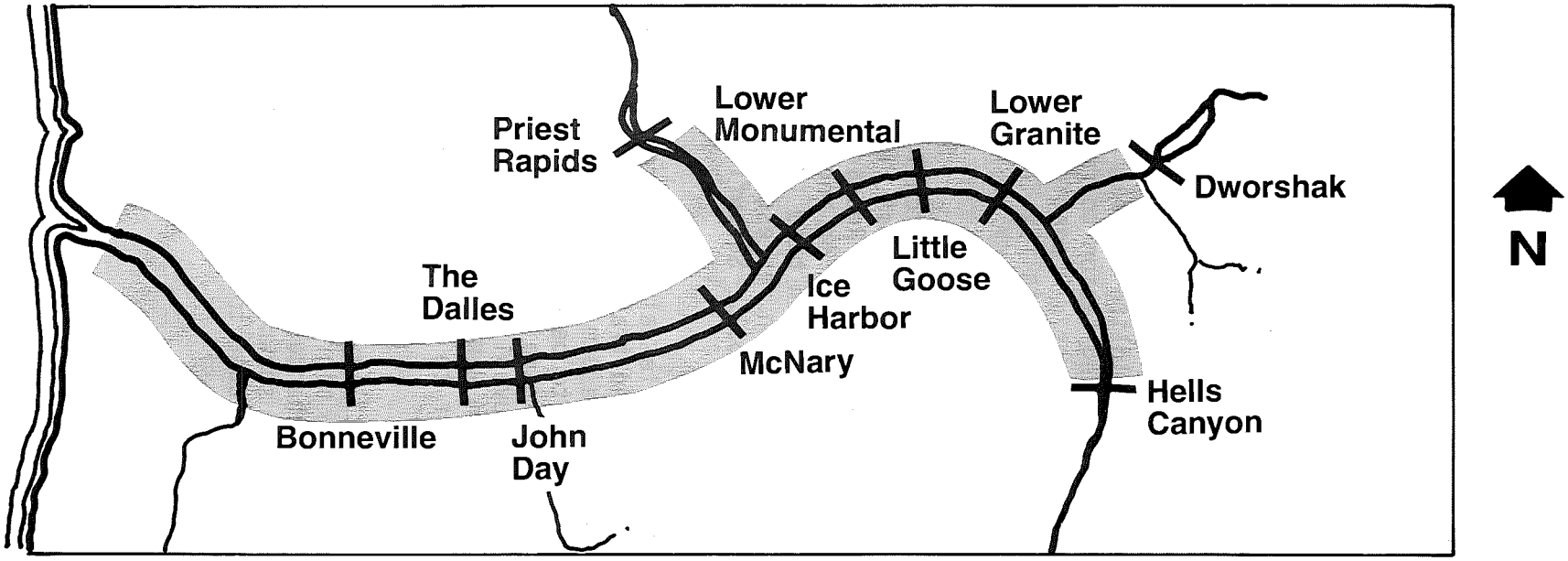
Sections 200 and 400 of the Northwest Power Planning Council's (Council) Columbia River Basin Fish and Wildlife Program (Program) identified reservoir mortality as an important limiting factor to reaching the Council's goal of doubling adult anadromous fish runs. Predation by resident fish in reservoirs was suspected as a major cause of mortality. The Council's Program directed BPA to "fund any further studies necessary to investigate juvenile salmon and steelhead losses to predators."

BPA has funded indepth predator-prey research in the John Day Reservoir since 1982. Results of this research suggest most, if not all, unaccounted losses in the reservoir were due to predation. Researchers estimated approximately 3 million juvenile salmonids are preyed on annually by squawfish, walleye (Stizostedion vitreum), and smallmouth bass (Micropterus dolomieui) in the John Day Reservoir. These 3 million represent an average of 14 percent of juvenile salmonids entering the pool. Squawfish were responsible for most losses.

One method of protecting juvenile salmonids from predation and other hazards currently used is collecting and transporting around the dams. Juveniles originating above Lower Granite Dam on the Snake River are collected and transported by barge or truck to below Bonneville Dam and then released into the Columbia River. Juveniles are also transported from Little Goose and McNary Dams. The remaining juveniles, and all juvenile salmonids entering the Columbia River downstream from McNary Dam, are exposed to hazards inriver, as are the transported fish prior to arriving at transport sites and following release below Bonneville Dam.

Reducing predator-caused mortality is anticipated to improve juvenile fish survival significantly. More migrating juveniles would survive at each reservoir, increasing their chance of survival to the ocean and increasing the number of adults returning to spawn. This and other measures to decrease juvenile mortality will contribute to the Council's goal of doubling returning adult fish runs.

Columbia River Basin



Columbia and Snake Rivers Federal Dams and Reservoirs.

Figure 2. Map of Reservoirs

1.3 BACKGROUND

In 1980, the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act) created the Northwest Power Planning Council. The Northwest Power Act directed the Council to: "promptly develop and adopt . . . a program to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries." The Act also gives BPA authority and responsibility to use its legal and financial resources to: "protect, mitigate, and enhance fish and wildlife to the extent affected by the development and operation of any hydroelectric project of the Columbia River and its tributaries in a manner consistent with . . . the program adopted by the Council . . . and the purposes of this Act."

As directed by the Northwest Power Act, the Council developed the Columbia River Basin Fish and Wildlife Program. One Program goal is to double the present run of adult anadromous fish returning to the Columbia River Basin from the ocean from about 2.5 million adults to 5 million adults. Reducing mortality of juvenile salmonids as they pass downstream is considered essential to increasing adult production.

Wild anadromous fish, such as salmon and steelhead, spawn in freshwater streams throughout the Columbia River Basin. The juveniles produced, and smolts reared in hatcheries and released into streams and lakes, travel to the ocean where they spend 1 to 5 years. As adults, they return to freshwater to spawn.

Dams on the Columbia and Snake Rivers, built for power generation, navigation, irrigation, and flood control, created reservoirs that slow the river's original flow and extend the time it takes smolts to travel to the sea. Some juveniles pass through turbines in the dams and become stunned and disoriented. Their weakened condition and the extra travel time needed to migrate through the pools make them more vulnerable to predators.

The lake environment created by the dams is a favorable environment for some native and introduced fish predators. The number of predators that prey on smolts has increased since development of the hydro system. The primary fish predator is the northern squawfish.

Squawfish are indigenous to the Columbia River Basin and live throughout the system. An adult squawfish can consume several juvenile salmonids per day, and account for approximately 80 percent of those lost to predators (in the John Day Reservoir). Squawfish are abundant in tailraces (the area below a dam), forebays (the area directly behind a dam), and reservoirs. If fewer squawfish existed in the system, juvenile salmonid losses would be expected to decrease.

CHAPTER 2

ALTERNATIVES CONSIDERED

2.1 ALTERNATIVES CONSIDERED AND ELIMINATED FROM FURTHER STUDY

Various alternatives to decrease predation were studied. Research was needed to determine the feasibility of decreasing the size of predator populations through predator control alternatives. The Oregon Department of Fish and Wildlife and the U. S. Fish and Wildlife Service evaluated eleven predator control alternatives identified through a literature search. Researchers evaluated alternatives using the following criteria:

- Demonstrated Success. An alternative must have been used successfully in a majority of field applications that were reviewed.
- Applicability. The alternative must have been used or judged as usable in a cool water system of a similar size to the Columbia River with a network of dams.
- Selectivity. The alternative must have been used or judged usable to control squawfish without having significant effects on other fish species.
- Absence of Side Effects. The alternative must not cause significant adverse environmental effect.
- Timeliness. The alternative must be suitable for implementation within no more than 2 years and take no longer than 4 years to see a measurable effect.

An alternative had a high potential if it met at least four of the five criteria, moderate if it met two or three, and low if it met fewer than two of the criteria. An alternative was also rated low if it had an unacceptable side effect even though it met other criteria. Table 1 (Evaluation of predator control measures) shows the alternatives evaluated and their rankings.

As Table 1 shows, the two predator control measures that received rankings with the highest potential were (1) netting and trapping, and (2) harvest regulation. Netting and trapping is relatively inexpensive and has little impact on the environment. But when tested, nets and traps could not be used successfully in turbulent dam tailwaters where predators are often located. Traps could be used only in backwaters and protected areas where there are fewer predators. Because of this limited use this measure is being considered for special applications such as for restricted zones around dams.

The second alternative to be considered because of its high potential was harvest regulation, which encouraged both commercial and sport harvest of squawfish.

TABLE 1 Evaluation of Predator Control Measures

Measure	Demonstrated Success	Applicability	Selectivity	Absence of side effects	Timeliness	Potential
Netting and trapping	+	+	+	+	I	High
Electrofishing	0	I	+	+	I	Moderate
Explosives	+	0	0	I	I	Low
Harvest Regulations	I	+	+	+	+	High
Water level manipulations	+	+	I	I	0	Moderate
Squoxin	+	I	+	I	0	Low
Antimycin	+	+	0	0	+	Low
Rotenone	+	0	0	0	+	Low
Sterilization	I	I	+	+	0	Moderate
Predator introduction	I	+	0	0	0	Low
Pathogen introduction	I	+	I	0	I	Low

LEGEND:

+ = Met criterion

0 = Did not meet criterion

I = Insufficient information to rate measure

High = Met 4 or 5 criteria

Moderate = Met 2 or 3 criteria

Low = Met 0 or 1 criteria or measure would have side effect(s) which is unacceptable even though all other criteria were met.

Another measure which had potential, is a specific toxin to squawfish called squoxin. Squoxin, discovered at the University of Idaho, is 100 percent lethal to squawfish at concentrations as low as 10 parts per billion applied for at least 2 hours. At this concentration, Squoxin is not lethal to salmonid species. However, no research has been done to determine latent mortality on salmonids. Squoxin is readily excreted by aquatic vegetation and animals and shows little tendency to accumulate in animal tissues. Aquatic invertebrates are generally resistant to Squoxin, with one exception, the blackfly Simulidae.

There is public resistance to treating fish chemically and scientific resistance to registering squoxin for further use. Many tests must be performed to find the effects of Squoxin on humans, since the chemical may enter the human water supply. Treating an entire reservoir is undesirable and may be impossible. Squoxin is not registered with the Environmental Protection Agency; registration could take 5-6 years. Because of these concerns, this measure was eliminated from further study.

All other alternatives shown on Table 1 had low potential to reduce predation and were eliminated from further study.

To gain more information on the harvest regulation alternative which showed high potential under the predator control measures, a study was initiated in 1988-1989 to evaluate the feasibility of methods for three fisheries: a squawfish commercial fishery, a sport-reward fishery, and an agency staffed hook and line fishery at Federal dams (Nigro, 1989).

To evaluate methods for a commercial fishery, researchers used three criteria:

1. The method would not incidentally harm valued fish such as salmonids, sturgeon, catfish, bass, or walleye.

2. The fishery would be inexpensive to commercial anglers using the small vessels already used for salmon, sturgeon, and shad fishing on the Columbia.

3. The fishery would have sufficiently high squawfish catch rates to provide a significant contribution toward an annual harvest objective for all squawfish fisheries of approximately 10-20 percent.

The following gear types were chosen to be tested because they are adaptable to commercial vessels used on the Columbia River and adjacent regions, and are suitable to the physical environment of the Columbia River reservoirs. Figures 3A-D (Gear Types) show these gear types. They are:

- Purse Seine. A purse seine is a large fishing net made to hang vertically in the water. It has weights on the bottom and floats on the top. The net is strung between two boats, and fish are caught in the net as it is pulled through the water and pursed into the shape of a bag. The seine used was 350 feet long and 27 feet deep.

- Long-Line. A long-line has a groundline 300-400 feet long, set with 50-75 baited hooks. The line can be fished at various depths.

- Gillnets. Gillnets trap fish as they try to swim through the net's mesh. Gillnets can be stationary or drifting. The gillnets used were both surface (75 feet long) and sunken (150 feet long) nets with a variety of mesh sizes.

- Baited Pots. Commercial shrimp pots, similar to crab pots, were used. Pots are baited with salmon smolts; the fish swim to the bait and then are trapped in the pot. Pots were fished individually with a buoyline attached to mark the location.

Comparisons among gear tested using the evaluation criteria showed that long-lines require the least investment and handling time and had the lowest incidental fish catch. Long-lines also caught the most squawfish. Squawfish composed 74 percent of fish caught by long-line, and incidental catch was usually alive and viable at release. Based on these findings the purse-seine, gillnet, and baited pot gear types were eliminated from further consideration for commercial harvest of squawfish.

Potential problems with long-lines include impacts to white sturgeon and channel catfish as incidental catch, bait availability, and entanglements with sport fishery gear. White sturgeon and channel catfish totaled 92 percent of the incidental catch and 24 percent of total fish caught. Most were hooked in outer mouth parts and could be released unharmed. But, 4 percent of the white sturgeon, and 10.5 percent of the channel catfish, captured and held, died. Smolts were the most effective bait used. Dead smolts were obtained from the McNary Dam juvenile fish bypass and sampling facility operated by the U.S. Army Corps of Engineers. Other baits tested were juvenile shad, trout-perch, cottids, salmon eggs, and cut chunks of squawfish and suckers. Long-lines became entangled with sport fishing gear in some locations. Setting fishing times, areas, and depths-of-sets can minimize potential conflicts with sport fishery gear.

Besides a commercial harvest of squawfish, a sport fishery also showed potential for harvesting predators. Researchers recommended an annual reward on squawfish to provide continuous predator control.

Researchers also recommended monitoring all fisheries to determine the effectiveness of the fisheries for reducing squawfish numbers, to observe the incidental catch and fish community responses to squawfish harvest, and to gather other information necessary for program management.

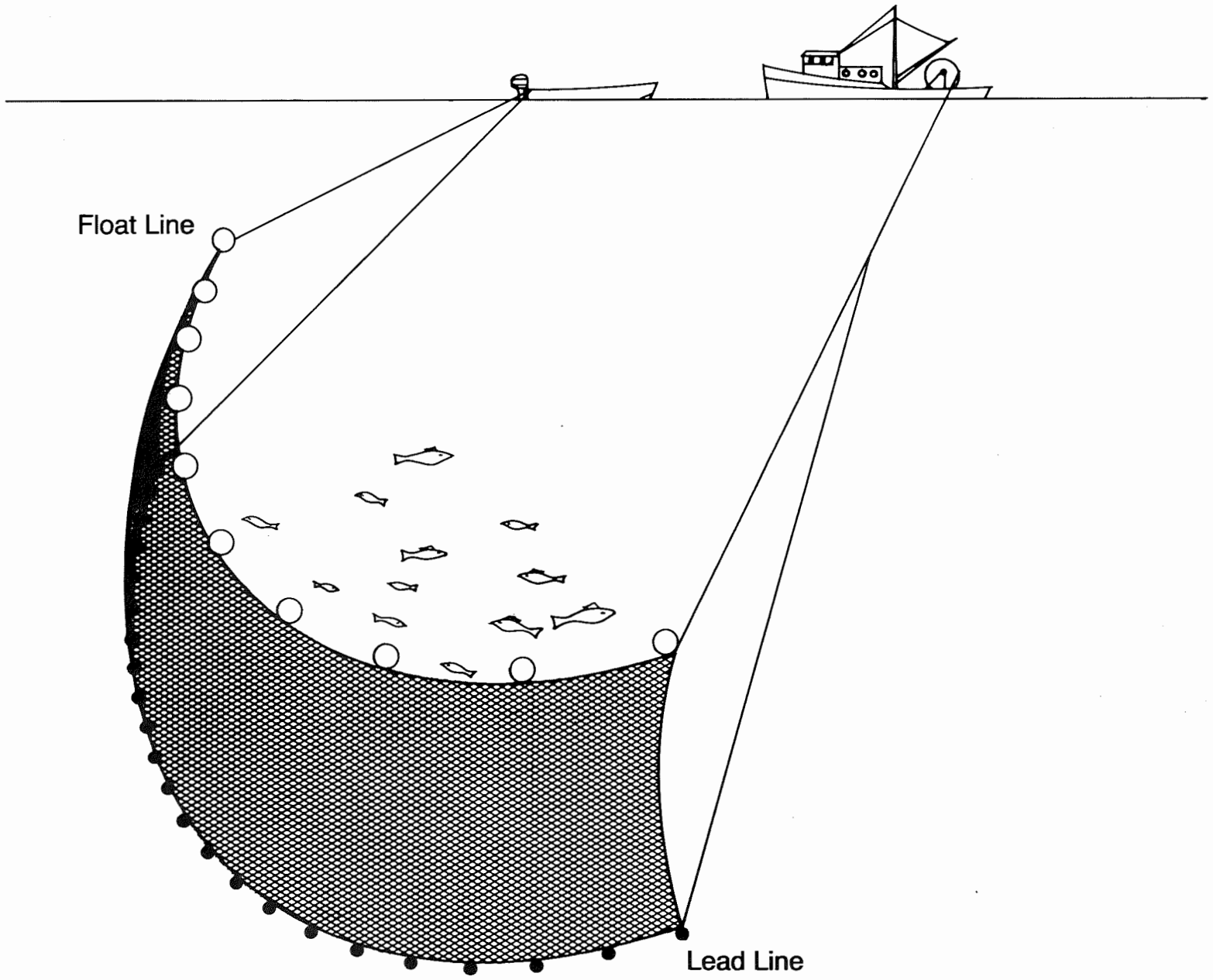


Figure 3-A. Purse Seine

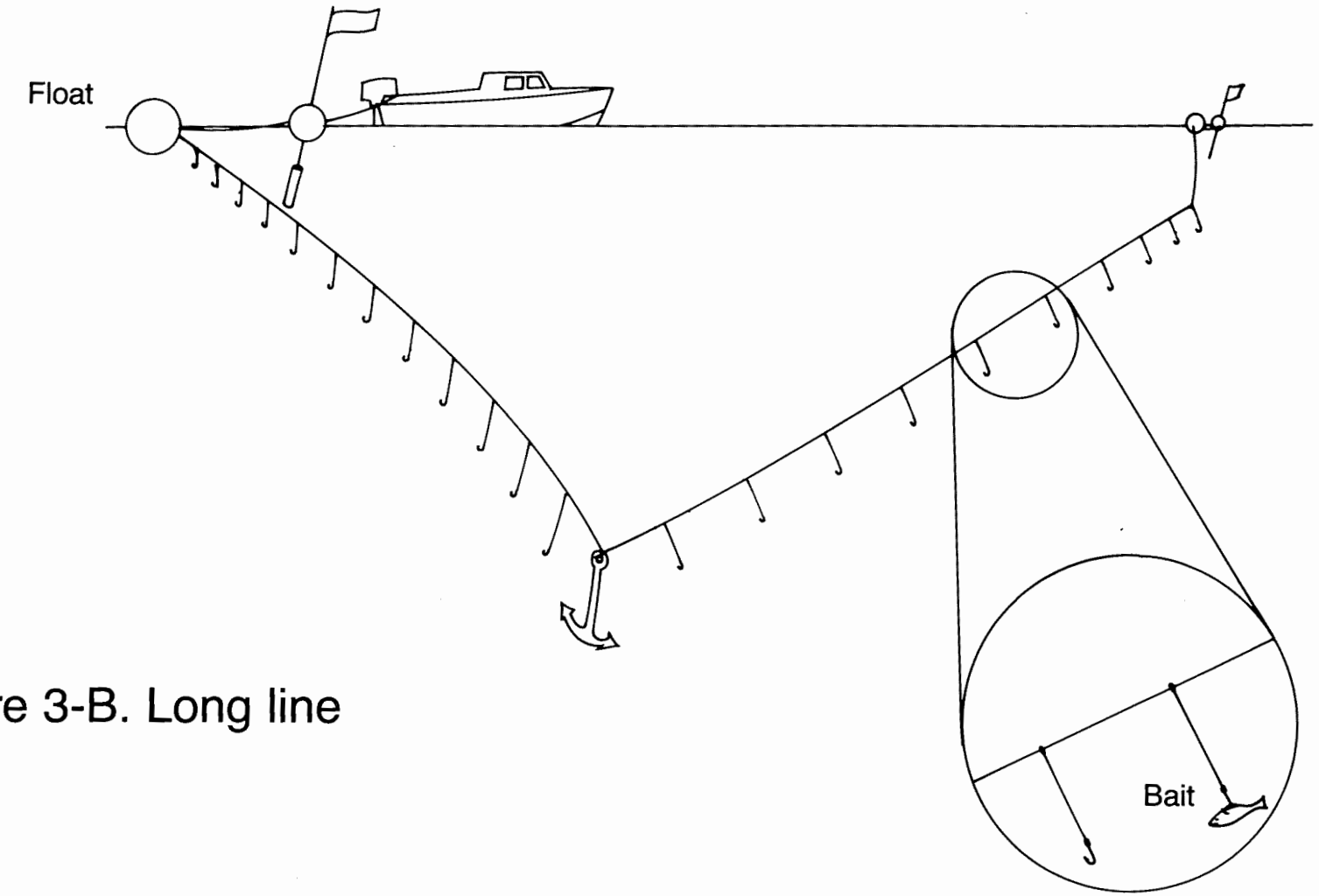


Figure 3-B. Long line

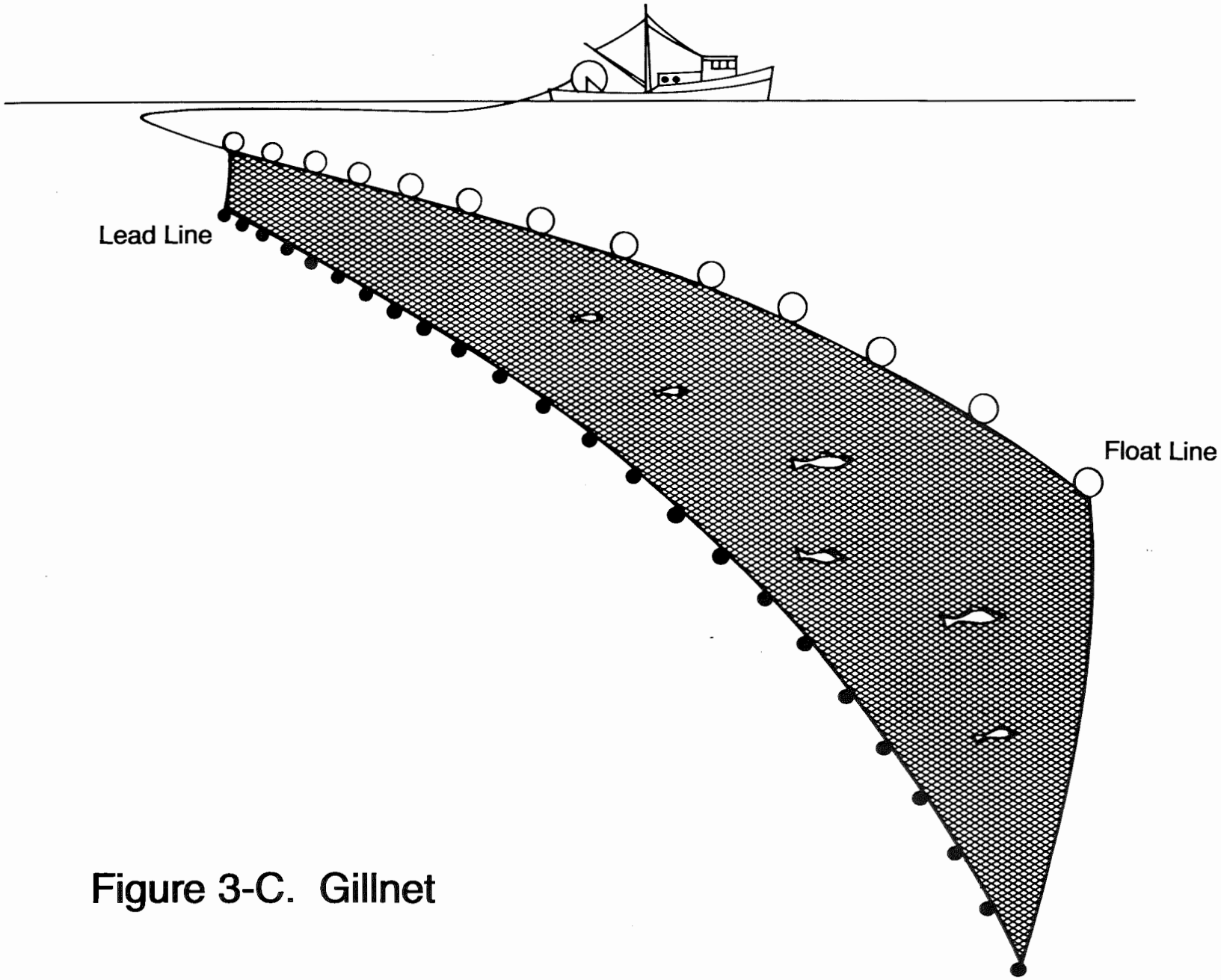


Figure 3-C. Gillnet

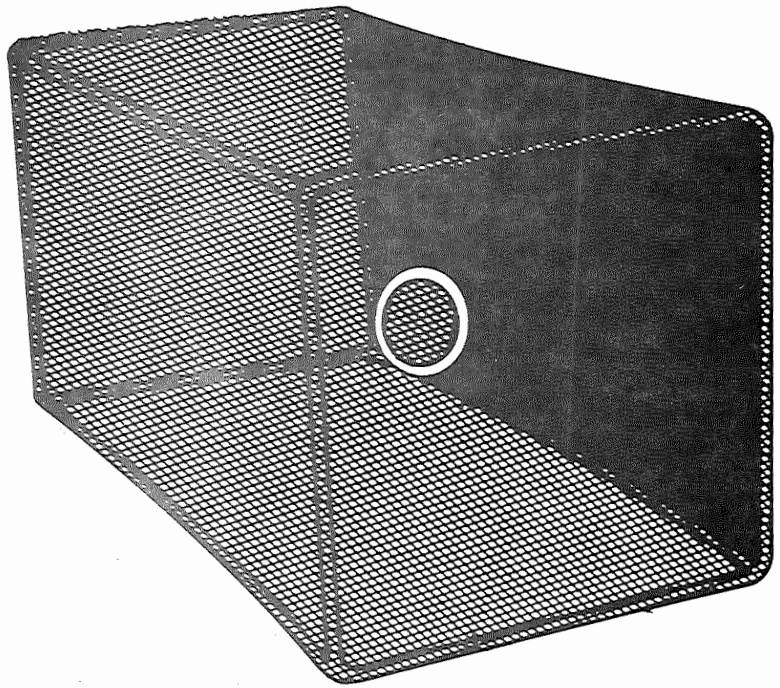


Figure 3-D. Pot Gear

2.2 PREFERRED ALTERNATIVE

Based on findings of the studies for evaluating the predator control measures and selection of gear types for commercial fishing of squawfish, the following alternative was developed. The preferred alternative consists of the three harvest methods: (1) commercial Tribal fishery; (2) sport reward fishery; and (3) fishing in restricted zones at dams. These fisheries were tested successfully in 1990. Commercial fishing would be implemented by Tribal anglers in the area of the Columbia River from Bonneville Dam to McNary Dam. This fishery would be restricted to Tribal anglers using long-lines as a gear type.

In 1991, a sport reward fishery would be established from the Bonneville Dam tailrace to Hells Canyon Dam tailrace. This program would be open to all appropriately licensed anglers. Reward would be $3 per squawfish. This reward amount could be increased in the future depending on participation. There would be at least two collection stations at each reservoir, one on each shoreline, with the exception of Little Goose Reservoir where there will be one station (as a result of limited access).

Dam angling also would be implemented at all eight Federal lower Columbia and Snake River dams. This fishery would be restricted to technicians under subcontract with the fishery agencies and Tribes. The technicians would fish from restricted areas of each dam.

In 1991, BPA proposes to fund squawfish management activities throughout the Federal hydrosystem on the lower Columbia and Snake Rivers from below Bonneville Dam to Priest Rapids Dam on the lower Columbia River, and from the mouth of the Snake River up the Snake River into Lower Granite Reservoir. In the future, regional entities may plan squawfish management in the Columbia River from Priest Rapids Dam to Chief Joseph Dam. Expanding the program would be dependent on funding, access for fishing from restricted area on non-Federal dams, and results of initial squawfish management efforts.

As part of this alternative an evaluation and monitoring program will be developed and operated. Monitoring will include evaluating how populations of squawfish and other predators respond to harvest, studying how juvenile salmonids are selected as prey, and developing and testing ways to remove predators and protect juvenile salmonids from predators. Utimately, juvenile fish survival and adult production would be used as the basis for determining the success of the program.

For ongoing program evaluation and program management, BPA, through State and Federal agencies, would collect biological data. This would include collecting incidental catch information, and monitoring the population structure and dynamics of the fish community to evaluate this alternative's effectiveness. In addition, BPA would continue to fund research on prey selection by squawfish, prey protection measures, and other squawfish harvest techniques (e.g., traps, electroshocking, etc.).

After 1991, it is anticipated regional fishery interests would establish these fisheries in non-Federal reservoirs of the Columbia River above Priest Rapids Dam to Chief Joseph Dam. Information collected from the BPA-funded Squawfish Management Program could be used in a similar program in non-Federal reservoirs. BPA does not plan to fund squawfish management in non-Federal reservoirs.

A diverse approach of combining intensive sport, commercial, and dam angling harvest will contribute toward the minimum objective of 10-20 percent reduction in the squawfish population. Combining these fisheries will affect a wide range of the squawfish population and ensure greater success during a variety of conditions.

2.3 NO-ACTION ALTERNATIVE

As required under the National Environmental Policy Act, the no-action alternative must be identified as a possible alternative. The no-action alternative would leave the present salmon and steelhead program unchanged. The no-action alternative would mean that no program would be initiated to reduce squawfish predation on juvenile salmonids in the Columbia River or Snake River reservoirs. Squawfish would continue to prey on juvenile salmonids migrating through the Columbia River system in the same numbers that occur now. The no-action alternative represents a lost opportunity to contribute toward the goal of doubling the salmon and steelhead runs and mitigating impacts from hydroelectric projects on these resources in the Columbia River Basin. The no-action alternative would be inconsistent with the Columbia River Basin Fish and Wildlife Program and the intent of the Northwest Power Act. Because the no-action alternative would not meet the need for the project, it is eliminated from further discussion in this document.

CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONCERNS

3.1 LAND USE

The Columbia River is the second longest river in North America, with the second greatest flow rate in the United States. The Columbia River Basin includes more than 258,000 square miles of drainage, including most of Washington, Oregon, and Idaho; Montana west of the Rocky Mountains; small areas of Wyoming, Utah, and Nevada; and southeastern British Columbia.

Hydroelectric and other land and water resource development activities altered the land use and environment in the Columbia River system. In 1933, the first dam, Rock Island, was built on the mainstem Columbia, followed by Bonneville Dam in 1938. In 1942, Grand Coulee Dam was completed. The reservoirs on the Columbia and Snake rivers support many water-related activities such as power generation, navigation, irrigation, flood control, and recreation, as well as fish and wildlife. This action would not affect the water available for these uses thereby affecting land use practices.

The following is a brief description of the reservoirs to be considered initially for squawfish management.

John Day Dam. John Day Dam, completed in 1971, is one of four "run-of-the-river" dams operated for hydroelectric power generation and navigation on the lower Columbia River. A run-of-the-river dam does not store water, but produces power from the natural run or flow of water downstream. The reservoir, Lake Umatilla, is about 76 miles long, with a surface area of about 52,000 acres. John Day Dam is also used for flood control, fishing, recreation, and irrigation.

Bonneville Dam. Bonneville Dam was built on the Columbia River for power generation and navigation. It is the farthest dam downstream on the Columbia River. It is also used for fisheries, recreation, and water quality. It is a run-of-the river project. The dam creates a 48-mile reservoir called Lake Bonneville.

The Dalles Dam. The Dalles Dam is at the head of Lake Bonneville. It was built in 1957 for power generation and navigation. It is also used for fisheries, recreation, irrigation, and water quality. It is a run-of-the-river project. The dam creates Lake Celilo, which is 24 miles long.

McNary Dam. McNary Dam, upstream from John Day Reservoir, was built on the Columbia River for power generation and navigation. It also is used for fisheries, recreation, irrigation, and water quality. It is a run-of-the-river project completed in 1957.

Ice Harbor Dam. Ice Harbor Dam, located about 10 miles from the mouth of the Snake River, was built for power generation and navigation. It also is used for fisheries, recreation, irrigation, and water quality. It is a run-of-the-river project completed in 1962. Ice Harbor Dam creates Lake Sacajawea, which is 32 miles long.

Lower Monumental Dam. Lower Monumental Dam is 32 miles upstream from Ice Harbor Dam. It was completed in 1969 for power generation and navigation, and is also used for fisheries, recreation, irrigation, and water quality. The dam creates a 28-mile long lake named Lake Herbert G. West.

Little Goose Dam. Little Goose Dam is 28 miles above Lower Monumental Dam. It forms Lake Bryan, which extends 37 miles up the Snake River. The dam was built for power generation and navigation, and also is used for fisheries, recreation, irrigation, and water quality. It is a run-of-the-river project and was completed in 1970.

Lower Granite Dam. Lower Granite Dam is 37 miles upstream from Little Goose Dam. It created 39-mile Lower Granite Lake. This dam was built for power generation and navigation, and is used for fisheries, recreation, irrigation, and water quality. It was completed in 1975.

Other reservoirs located on the Columbia River and described below may be considered for squawfish management based on the outcome of the initial program efforts and availability of funds.

Priest Rapids Dam and Lake. Priests Rapid Dam is 105 miles upstream from McNary Dam. Priests Rapid Dam is owned by Grant County Public Utility District #2. It is used for power generation and recreation, and is a run-of-the-river project. This project was completed in 1961. The reservoir behind the dam is 18 miles long.

Wanapum Dam. Wanapum Dam, 18 miles upstream from Priest Rapids Dam on the Columbia River, was completed in 1964. Grant County Public Utility District #2 owns this dam. It is used for power generation and recreation. Its reservoir is 38 miles long.

Rock Island Dam and Lake. Located 38 miles upstream from Wanapum Dam is Rock Island Dam, owned by Chelan County Public Utility District #1. It is a run-of-the-river dam used for power generation. The lake created by the dam is 21 miles long. The first powerhouse was completed in 1933.

Rocky Reach Dam and Lake. Rocky Reach Dam is 38 miles upstream from Wanapum Dam. Chelan County Public Utility District #1 owns this dam. It is used for power generation and recreation. A run-of-the-river project, it was completed in 1933. Its reservoir is 42 miles long.

Wells Dam and Lake. Wells Dam, completed in 1967, is owned by Douglas County Public Utility District #1. It is used for power generation, flood control, and recreation. It is a run-of-the- river project. The lake is 29 miles long.

Chief Joseph Dam and Rufus Woods Lake. The U.S. Army Corps of Engineers completed this run-of-the-river project in 1961. It is used for power generation, recreation, water quality and irrigation. Located 29 miles upstream from Wells Dam, the dam created the 52 mile long Rufus Woods Lake.

Environmental Concerns. The proposed Squawfish Management Program would not have an effect on water used for power generation, irrigation, navigation, or flood control. No water will be diverted or used. Because none of these reservoirs is within the coastal zone of Washington or Oregon, this proposed program is not under the jurisdiction of the Coastal Zone Management Act (16 USC 1451 et seq.). BPA consulted State and local jurisdictions to ensure that this proposal is consistent with their plans and policies. Since this proposal does not change any land use, and will not affect shorelines or cause discharges to water, this proposal is consistent with local plans and zoning.

In accordance with Executive Order 12372, this Environmental Assessment will be circulated to clearinghouses for State, Tribal, and local agency review and consultation.

3.2 FISHERIES

The tributaries, lakes, and upper portions of the Columbia River system are the major spawning and rearing areas for anadromous fish. The principal anadromous fish in the Columbia Basin are steelhead trout (Oncorhynchus mykiss); three species of salmon (chinook (Oncorhynchus tshawytscha), coho (Oncorhynchus kisutch), and sockeye (Oncorhynchus nerka)); and shad (Alosa sapidissima). Other anadromous species include white sturgeon (Acipenser transmontanus), eulachon (Thaleichthys pacificus), and Pacific lamprey (Lampetra tridentata).

Anadromous fish must pass up to nine dams on the Columbia River as they migrate from the rivers to the ocean and back to the rivers to spawn. Fish spawning in the Snake River or the Salmon River must pass over eight dams (four on the Columbia; four on the Snake River). In 1942, Grand Coulee Dam effectively blocked all salmonid migrations into the Upper Columbia River. Chief Joseph Dam on the Columbia River and Hells Canyon Dam on the Snake River are now the upstream limits of anadromous fish migration. The lakes created by the dams slow the flow of water to the ocean and allow water temperatures to increase in the summer.

The Columbia River and its tributaries also contain a variety of resident fish. Resident fish spend their entire life in fresh water, although some migrate through the fresh-water system. Resident fish include squawfish, trout, and warm water species such as the largemouth bass (Micropterus salmoides), bluegill (Lepomis machrochirus), and crappie (Pomoxis nigromaculactus).

The fish community in John Day Reservoir contains 34 species of resident and anadromous fish. This community is representative of the fish community of

the Columbia River system. Table 2 (Fish Species - Index Sampling) shows fish species in the lower Columbia River caught during index sampling in 1990.

Predation in the fish community of the reservoirs in the Columbia Basin is complex. During 1982-1988, BPA funded research in the John Day Reservoir to learn about predation on juvenile salmonids. The John Day Reservoir has three attributes considered important by researchers: (1) the reservoir is an important subyearling chinook rearing area; (2) smolt passage and residence time in the reservoir were considered problems due to the large size of the reservoir; and (3) large predator populations were known to exist in the reservoir.

Researchers studied the diet of the four major predator species in John Day Reservoir, the native northern squawfish and three introduced species -- walleye, smallmouth bass, and channel catfish (Ictalurus punctatus). Previous resident fish studies indicated they were abundant. Fish was the dominant prey group (by weight) for these species. Pacific salmon and steelhead (Oncorhynchus species) juveniles were the most important food group for northern squawfish -- 66.7 percent by weight. Salmon and steelhead juveniles were a lesser proportion for other predators: 32.9 percent for catfish, 13.5 percent for walleye, and 3.7 percent for smallmouth bass. Squawfish, smallmouth bass, and channel catfish also preyed on other fish, crustaceans, and insects. In contrast, 96.4 percent of the walleye diet is fish. Next to fish, crayfish were the second most important food by weight for squawfish, smallmouth bass, and channel catfish. Insects were frequently consumed but made up little of the bulk in their diet. Other studies show that prickly sculpin and suckers were the most important prey of walleye, and juvenile salmonids comprised only 3.6 percent by volume of the walleye diet (Poe and Rieman, 1988).

Researchers found that loss and mortality estimates of salmonids varied from month to month. Prey consumption may vary as prey number varies or by season. Temperature influences predator metabolic demands and consumption rates for squawfish. In other words, the higher the temperature, the greater the metabolic rate and consumption rate. Because of this variability, mortality rates to predators of different stocks of salmonids migrating through the system varies. Stocks of spring chinook salmon and steelhead migrating in April and May experience lower predation mortality than fall chinook migrating primarily during the summer when the water is warmer. Fall chinook salmon also may be more vulnerable to predators because they move more slowly through the reservoir and are smaller than spring chinook salmon or steelhead. Using the results of this study of predation, researchers believe that changes in the environment or prey characteristics can have an important influence on fish losses (Poe and Rieman, 1988).

TABLE 2 - FISH SPECIES - INDEX SAMPLING

COMMON FISH NAME	FAMILY	*GENUS*
Northern Squawfish	Cyprinidae	*Ptychocheilus oregonensis*
Carp	Cyprinidae	*Cyprinus carpio*
Chiselmouth	Cyprinidae	*Acrocheilus alutaceus*
Goldfish	Cyprinidae	*Carassius auratus*
Peamouth	Cyprinidae	*Mylocheilus caurinus*
Redside shiner	Cyprinidae	*Richardsonius balteatus*
Longnose dace	Cyprinidae	*Rhinichthys cataractae*
Speckled dace	Cyprinidae	*Rhinichthys osculus*
Bridgelip sucker	Catostomidae	*Catostomus columbianus*
Largescale sucker	Catostomidae	*Catostomus macrocheilus*
American shad	Clupeidae	*Alosa sapidissima*
Sand roller	Percopsidae	*Percopsis transmontanus*
Threespine	Gasterosteidae	*Gasterosteus aculeatus*
Prickly sculpin	Cottidae	*Cottus asper*
White sturgeon	Acipenseridae	*Acipenser transmontanus*
Brown bullhead	Ictaluridae	*Ictalurus nebulosus*
Channel catfish	Ictaluridae	*Ictalurus punctatus*
Pumpkinseed	Centrarchidae	*Lepomis gibbosus*
Bluegill	Centrarchidae	*Lepomis machrochirus*
White Crappie	Centrarchidae	*Pomoxis annularus*
Black Crappie	Centrarchidae	*Pomoxis nigromaculatus*
Smallmouth bass	Centrarchidae	*Micropterus dolomieui*
Largemouth bass	Centrarchidae	*Micropterus salmoides*
Yellow perch	Percidae	*Perca flavescens*
Walleye	Percidae	*Stizostedion vitreum*
Coho salmon	Salmonidae	*Oncorhynchus kisutch*
Sockeye salmon	Salmonidae	*Oncorhynchus nerka*
Chinook salmon	Salmonidae	*Oncorhynchus tshawytscha*
Rainbow trout	Salmonidae	*Oncorhynchus mykiss*
Mountain whitefish	Salmonidae	*Prosopium williamsoni*

Researchers also studied how many juvenile salmonids squawfish consume and where squawfish are located. In 1990, data were collected from the Bonneville Dam tailrace on the Columbia River upstream to the Ice Harbor Dam tailrace on the Snake River. By studying consumption of juvenile salmonids by squawfish and squawfish abundance in other reservoirs in the Columbia and Snake Rivers, researchers can provide an estimate or index of the "significance" of predation for the entire Columbia River Basin, relative to the John Day Reservoir. This research also establishes a baseline for future evaluation of the effect of squawfish management.

Preliminary results of the predation indexing completed in 1990 show squawfish abundance increases downstream from John Day Reservoir. For example, there are twice as many squawfish in Bonneville Reservoir as there are in the John Day Reservoir. From John Day upstream, squawfish numbers decrease. These studies also found that squawfish consumption of juvenile salmonids was generally highest in tailraces and forebays and lowest in midreservoir. Consumption was generally higher during the summer than spring because higher water temperature increases predator activity.

Combining the abundance index with the consumption index produces the predation index. Figure 4 (Predation Indexing) shows the preliminary index of predation on juvenile salmonids by squawfish in the lower Columbia River relative to predation in the John Day Reservoir. This information shows squawfish predation on juvenile salmonids is not unique to the John Day Reservoir, is of a similar order of magnitude to John Day, and a significant problem throughout the lower Columbia River. Indexing is planned for 1991 to determine the significance of squawfish predation on juvenile salmonids in the lower Snake River, from Ice Harbor to Hells Canyon Dam.

Researchers used computer simulations to predict potential changes in predation by squawfish if squawfish were harvested. Their objective was to describe predation responses caused from sustained moderate or intensive predator removal. Their results showed the following:

- Squawfish removal had an important influence on potential simulated predation. Potential predation declined dramatically with removal in each simulation, although results were dependent on the squawfish reproduction assumption used.

- Sustained removal of between 9 and 18 percent of the squawfish populations, depending on the assumption used in the model for squawfish reproduction, was necessary to reduce predation to 50 percent of the original amount. Middle and older age classes actively preyed on juveniles in the original population, but predation shifted toward younger squawfish when older fish were removed. The time needed to reach a 50 percent predation reduction depended on the level of removal, but ranged between 3 and 10 years for harvest rates of 15 percent to greater than 30 percent.

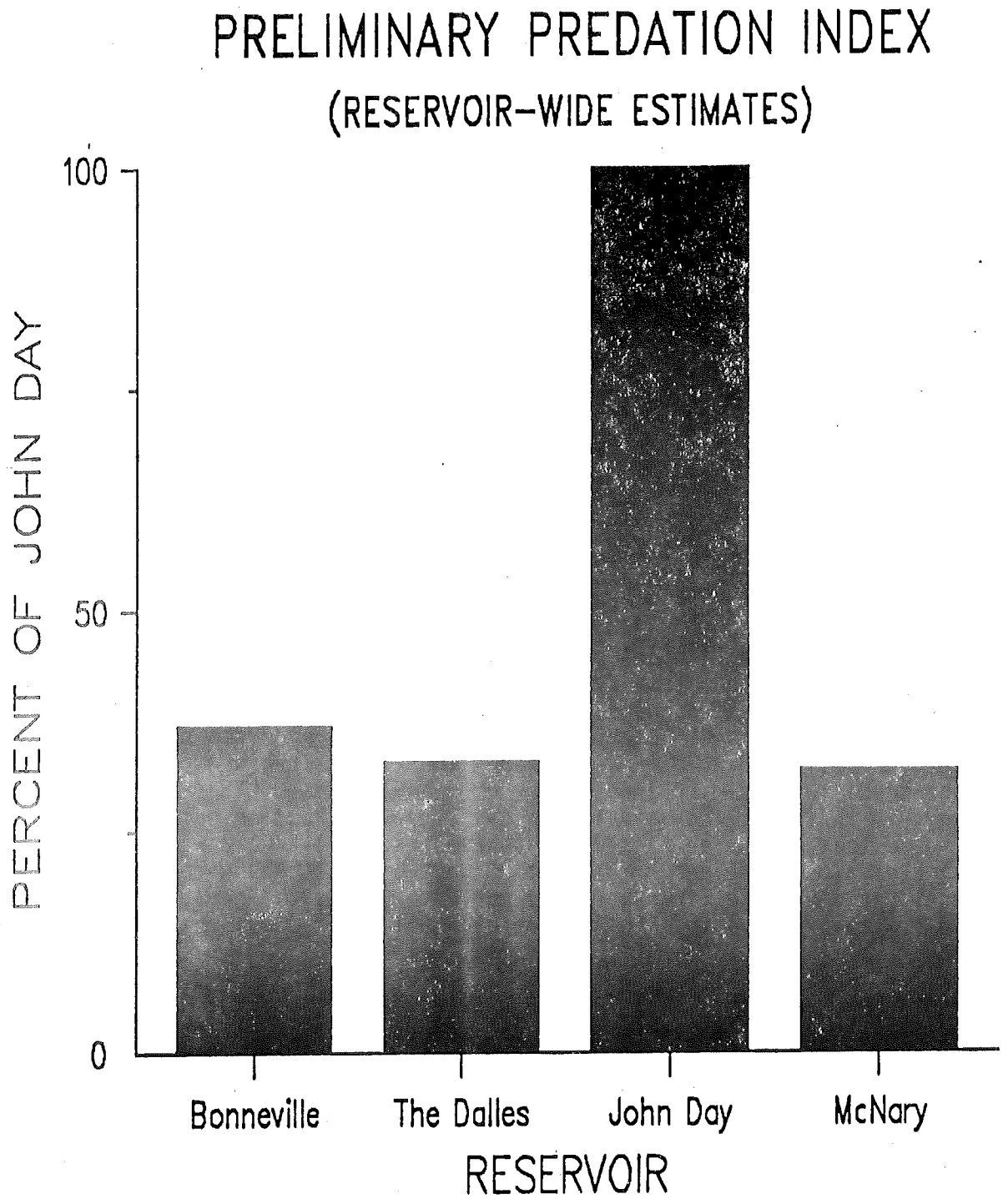


Figure 4 . Preliminary index of predation on juvenile salmonids by northern squawfish in lower Columbia River reservoirs relative to predation in John Day Reservoir. The index is the product of an abundance index and a consumption index.

- The computer model showed that if removal stops, squawfish populations recovered 90 percent of their original number in 6 to 30 years depending on the assumptions used for squawfish reproduction. If smaller squawfish or other fish respond to the void created by removing large squawfish by growing faster and larger than normal and preying on more smolts, and there is no net change in predation or the change is not as great as anticipated, the populations have "compensated" for the removal. In some simulations a drop in removal resulted in overcompensation, and predation exceeded the original level.

These results suggest some risk in a control program that is not sustained. The response is dependent on squawfish reproduction. In most eradication programs for other fishes, however, no reproductive compensation was found. Noting the population characteristics of squawfish, researchers think because squawfish are slow growing and exhibit low mortality compared with other species, the squawfish population would not rebound with increased reproduction after a removal program (Poe and Rieman, 1988).

In 1990, BPA funded research in the John Day Reservoir to decide what fishing techniques might be used to harvest the most squawfish without significant incidental catch of other fishes. Three harvest methods--a commercial Tribal fishery, a sport reward fishery, and dam angling--were tested and are described below.

Tribal anglers used small boats on the reservoir and fished with long-lines for the commercial Tribal test fishery. Long-lines are weighted fishing lines that can hold 50-75 baited hooks at different depths in the water. Three Tribal crews participated. Each crew had two Tribal members and an Oregon Department of Fish and Wildlife observer. The fishery began June 12 and ran through August 10. Crews fished Monday through Thursday. The reservoir was divided into three sections and each crew fished one section each week, rotating so that each crew fished all three sections over a 3-week period. Approximately 10 long-lines with about 50 baited hooks each were fished by each crew per day. The lines were set for 6 to 8 hours. The squawfish were held on ice to preserve them for marketing. All other fishes caught were released.

The sport reward fishery in the John Day Reservoir was open to all licensed anglers. Anglers fishing in the reservoir could catch squawfish and receive a reward. Anglers could also fish in backwaters, sloughs, and impounded reaches of tributaries. The fishery began May 24 and ran through September 3. It was conducted 4 days each week, Thursday through Sunday and holidays. Anglers were required to register each day at one of four sites. Anglers were eligible for a reward for any squawfish over 11 inches caught during that day. Originally a reward of $1 per fish was paid for each squawfish. This reward amount attracted few anglers. To increase participation, the reward was raised to $3 per fish in July 1990. This amount could increase depending on participation at this rate.

Technicians hired by the Oregon Department of Fish and Wildlife fished within restricted areas of dams for the dam angling fishery test. Anglers used hand-held poles, with different hook and line configurations, at five dams on the lower Columbia and Snake Rivers. Twenty-two anglers fished from April 30 through August 31, five 8-hour days per week. Various hours, baits, and equipment were tested.

The 1990 John Day Reservoir test fisheries harvested 9,951 squawfish, or approximately 12 percent of the estimated squawfish population. Sport-reward harvested the highest percentage of squawfish (47 percent) with a total of 2,376 anglers participating, with dam angling next highest (39 percent), followed by the commercial long-line fishery (14 percent).

To learn the impact of these fisheries on other fish species, the incidental catch of species other than squawfish was counted during the commercial and dam angling fisheries. Data were not collected for the sport reward fishery, since these anglers targeted game fish and the squawfish were often the incidental catch. Species other than squawfish accounted for 26 percent of the total catch in the commercial fishery. In the dam angling fishery, 4 percent of the total catch were other fish. Table 3 gives incidental catch totals from the 1990 test fisheries. Table 4 gives incidental catch numbers by species from the 1990 squawfish test fisheries. Tests to determine delayed mortality of incidentally caught fish were conducted. Results show low levels of delayed mortality for incidental catch.

A regulatory review questionnaire describing the three 1990 test fisheries was sent to the Columbia River Inter-Tribal Fish Commission, State agencies, Federal agencies, and Public Utility Districts. These entities were asked to identify any concerns and provide information on existing regulations with which conducting these fisheries may be inconsistent. Responses referred to existing regulations on commercial and sport fisheries as outlined in Columbia River Compact Documents, Oregon Department of Fish and Wildlife regulations, and Washington Department of Wildlife regulations. Concerns are summarized below.

Commercial Fishery:

- Zone 6 participation should be limited to treaty Tribe members. BPA is proposing that Zone 6 be limited to Tribe members.

- Incidental catch needs to be monitored and documented -- there is a concern about incidental catch of salmon and steelhead. BPA is proposing a monitoring and evaluation program as part of the preferred alternative that includes monitoring incidental catch of these and other species.

- Legislation will be required to change squawfish from an "unclassified" to a "food fish" in Washington State before full-scale implementation of a commercial fishery.

TABLE 3 - INCIDENTAL CATCH FOR 1990 NORTHERN SQUAWFISH TEST FISHERIES

FISHERIES TYPES	TOTAL CATCH	TOTAL NORTHERN SQUAWFISH	OTHER FISH (INCIDENTAL CATCH)	PERCENTAGE OF INCIDENTAL CATCH
COMMERCIAL	1,908	1,420	488	26%
DAM ANGLING	11,428	11,005	423	4%
TOTAL	13,336	12,425	911	7%
NOTE: Figures not collected for sport reward fishery.				

TABLE 4 - INCIDENTAL CATCH IN SQUAWFISH FISHERIES BY SPECIES

MAY-AUGUST 1990

COMMON FISH NAME	COMMERCIAL	DAM ANGLING	TOTAL
Northern Squawfish	1,420	11,005	12,425
Carp	3	1	4
Largescale sucker	4	0	4
Catostomus species	3	1	4
American shad	6	39	45
Prickly sculpin	0	4	4
Cottus species	7	0	7
White sturgeon	269	59	328
Brown bullhead	3	0	3
Channel catfish	182	294	476
Smallmouth bass	8	0	8
Largemouth bass	0	3	3
Yellow perch	2	0	2
Walleye	1	2	3
Chinook salmon	0	1	1
Rainbow trout	0	19	19
TOTAL	488	423	911

- Individual Tribes maintain their right to develop their own fishery management plans for squawfish in Zone 6. At this time, the Tribes and the Columbia River Inter-Tribal Fish Commission are comfortable with the proposed long-line fishery in Zone 6.

- Full-scale commercial fishery implementation needs to be reviewed by tribal governing bodies and the Columbia River Inter-Tribal Fish Commission.

- The Tribes may be concerned if sport anglers participate in the sport reward fishery as a commercial fishing venture.

Sport Reward Fishery:

- Full-scale implementation would require compliance with existing sport fishery regulations, and good monitoring and enforcement programs must be provided. Good monitoring and enforcement programs should deal with incidental catch of game and salmon species. BPA is proposing to comply with existing sport fishery regulations and monitor incidental catch for these species.

- There is concern about ownership and use of access sites at three lower river reservoirs. Negotiations between the U. S. Army Corps of Engineers and the Tribes are ongoing. It is anticipated access to sites will be allowed by the Tribes.

- There is concern about the quasi-commercial nature of the reward fishery in Zone 6. Given the results of the 1990 sport reward fishery, this concern may be minimized because sport anglers are not participating in the reward fishery on a commercial basis. The States are coordinating this fishery through the Columbia River Compact.

Dam Angling Fishery:

- Participation should be restricted to authorized public agency employees. Special authorization would be required. Fishing locations will be restricted for safety and security reasons. BPA proposes that this fishery be limited to public agency employees. Fishing locations will be restricted. This fishery is being closely coordinated with the U. S. Army Corps of Engineers, the dam operators.

All Fisheries:

- Columbia River Compact regulations outline restrictions that would apply for all fisheries on fish handling, size restrictions, end uses, and incidental catch. BPA proposes to comply with these regulations, to the extent that they apply.

Benefits to Fisheries. Harvest from the three proposed fisheries is estimated at over 200,000 squawfish in 1991. Decreasing squawfish numbers is

expected to improve salmon and steelhead survival. Researchers think reducing predator numbers can cause changes in a predator's population structure. Even if a small part of a predator population is removed, if the removal continues, a significant decrease in predation is possible (Poe and Rieman, 1988).

Squawfish harvest will benefit all species of salmon, but the benefit will be greatest for fall chinook. Based on results of computer modeling by BPA, a 50 percent reduction in squawfish predation at each reservoir in the lower Columbia and Snake Rivers may increase relative juvenile salmonid survival to below Bonneville Dam by 14, 16, 34, and 16 percent respectively, for spring chinook, summer chinook, fall chinook, and sockeye originating upstream of Lower Granite Dam. Many upriver stocks benefit from transportation around the dams. Fish stocks originating below Little Goose Dam may experience a higher relative increase in survival because of increased exposure to predators compared to the upriver stocks.

The benefits of reducing squawfish are immediate, but achieving a 50 percent reduction in juvenile salmonid losses to predation would be achieved over time. Based on computer modeling of predator-prey dynamics, researchers hypothesize that reducing squawfish numbers by 10-20 percent annually, on a sustained basis, may reduce predation by up to 50 percent within 5 to 10 years. These results show that if the harvest of squawfish stops, the squawfish population can recover and return to its original population numbers. Therefore, the effect of squawfish management on the squawfish community is reversible.

Researchers also hypothesize that reducing squawfish may increase the fish guidance efficiency of submersible traveling screens (see Figure 5 - Traveling Screens). These screens, located within the turbine intakes, divert juvenile salmonids from the turbine intake and guide them into a channel and past the dam. Large numbers of squawfish immediately upstream of the turbine intake may cause salmonids to distribute deeper in the water column, where they are too deep to be affected by the screens and more vulnerable to passing through the turbine. Removing squawfish may result in a redistribution of juvenile salmonids higher in the water column where they will encounter the screens, and be guided away from the turbines more effectively.

Incidental Catch Concerns. An important consideration in determining appropriate squawfish harvest fisheries is the number of nontarget fishes caught (i.e., incidental catch). Data collected in 1990 indicates the fisheries tested (e.g., long-line and dam angling) do not result in significant catches of nontarget species. Delayed mortality of incidental catch was shown to be low during studies conducted in 1989 and 1990. Incidental catch in the sport reward fishery is of less concern, because most anglers participating in this fishery are targeting fishes other than squawfish (e.g., salmon, steelhead, walleye, sturgeon, etc.); the squawfish is the incidental catch in this fishery.

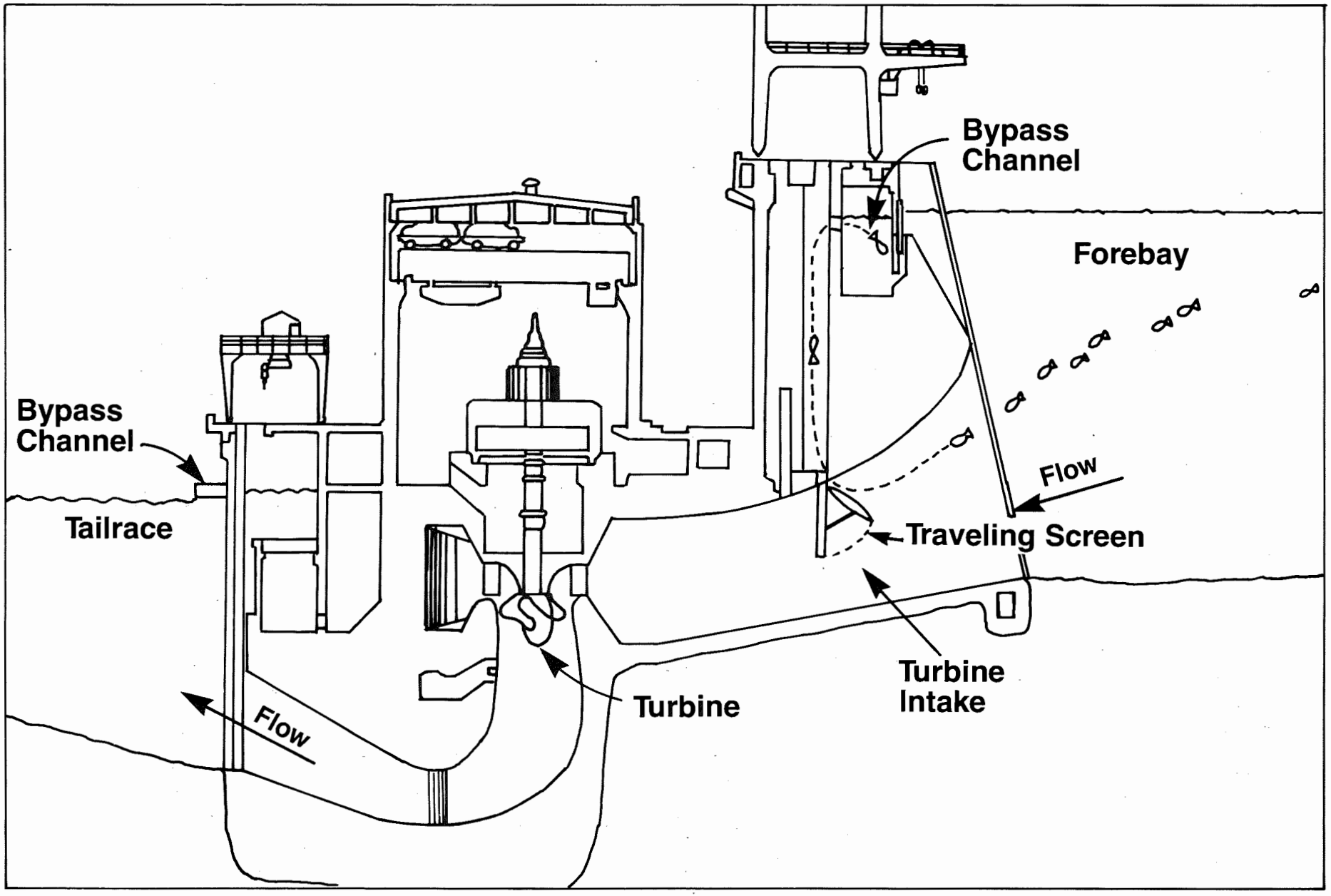


Figure 5. Traveling Screens

Intraspecific Competition. The remaining squawfish population could respond to reduced numbers of large squawfish and increased numbers of smolts. Remaining squawfish could fill the void left by removing the large squawfish and could consume more salmonids, reproduce earlier and more often, and grow faster because of reduced competition from the larger squawfish. This compensation by the remaining squawfish could reduce the benefits anticipated from any removal program. If the squawfish removal program is not sustained, predation could be aggravated if removal restructures the population and increases the number or size of predators. Strong compensation is unlikely. Manipulating the population is necessary to understand the response. Ongoing monitoring and evaluation will provide information on this response and a basis for program management.

Interspecific Competition. In complex natural communities, reducing one predator may cause other predators to grow faster or increase their numbers. Interaction among predator fish species in the community also could reduce the benefits anticipated from predator control. For example, walleye may become more important as predators if more smolts are available. But because walleye do not select salmonids as their first choice of prey, they may never exceed squawfish in total predation. Walleye abundance is much less than squawfish and populations tend to be regulated by environmental conditions. Predation of juvenile salmonids by smallmouth bass is often by encounter; salmonids are not specifically sought by smallmouth bass. Therefore, researchers do not anticipate significant interspecific compensation because of squawfish harvest. The purpose of the monitoring and evaluation associated with this program is to gather data on how squawfish and other predators respond to the program, to delineate these potentialities for change, and adjust the program to the predators' response.

Biological Risk. There is generally regional agreement that there is little biological risk from harvesting squawfish. Monitoring squawfish population structure and dynamics and how squawfish and other species respond to the removal of squawfish will occur on an ongoing basis. If information collected from monitoring shows that harvesting squawfish is effective, the program will be expanded. Likewise, the program will be modified, as necessary, in response to data collected.

The Endangered Species Act of 1973 provides for conserving endangered and threatened species of fish, wildlife, and plants. Federal agencies must ensure that proposed actions do not jeopardize the continued existence of any endangered or threatened species or cause the destruction or adverse modification of their critical habitat. The National Marine Fisheries Service is considering whether to list several runs of Columbia and Snake river chinook, coho, and sockeye salmon as endangered or threatened species under the Endangered Species Act. Responding to this, BPA proposes implementation of squawfish management on an accelerated schedule. The accelerated schedule would implement the sport fishery in the Snake River immediately, concurrent with indexing to determine the significance of predation at those locations. The level of effort for the squawfish fisheries would be based on the 1990 results from John Day Reservoir to ensure that the harvest target is achieved.

BPA is preparing a Biological Assessment for the U. S. Fish and Wildlife Service to determine if there will be adverse effects from this program on two endangered species, the Bald Eagle and the Perigrine Falcon.

The Fish and Wildlife Coordination Act requires that fish and wildlife receive equal consideration with other elements of a proposed action. The preferred alternative would benefit salmonids, but will directly affect squawfish and may incidentally affect other species.

The preferred alternative responds to Sections 200 and 400 of the Columbia River Basin Fish and Wildlife Program and is consistent with the Council's Conservation and Electric Power Plan.

3.3 WATER RESOURCES

John Day Reservoir is typical of other water resources considered for the proposed action. The reservoir, Lake Umatilla, is about 76 miles long, with a surface area of about 52,000 acres. Offshore depths range from about 30 feet on the upper reservoir to about 150 feet near John Day Dam. Seasonal fluctuations of the reservoir can vary as much as 11 feet. Water current is measurable throughout the reservoir. The shoreline is typically steep; parent material is basalt. Precipitation is low, and shoreline vegetation is limited. Water temperature ranges from 0° to 27° Centigrade with lows in January or February and highs in August. Juvenile salmon and steelhead are present in the reservoir year-round, but most of these fish migrate as smolts from April through August.

Environmental Concerns. There will be no new facilities or other development in a floodplain, so this action is consistent with Executive Order 11988, Floodplain Management, which mandates Federal agencies avoid floodplain development whenever there is a practicable alternative. Because this action will not affect water quality or discharge pollution to the water, water quality standards will not be exceeded, and this action is consistent with the Federal Water Pollution Control Act (33 USC 1251 et seq.), the Clean Water Act (33 USC 1344) and will not require a National Pollution Discharge Elimination System permit.

3.4 RECREATION

In the Pacific Northwest, Federal hydroelectric projects provide many opportunities for recreation at reservoirs and the areas downstream of the projects. Boating, swimming, water skiing, and fishing are typical water related recreational activities; other recreation opportunities include camping, picnicking, sightseeing, hiking, windsurfing, wildlife viewing, and hunting. Many recreational activities are influenced by changes in reservoir elevation and downstream flows.

Recreation facilities for boating and fishing are available at all reservoirs. No new facilities are proposed.

Benefits to Recreation. The preferred alternative will enhance sport fishing by providing a monetary incentive for squawfish and an additional angling opportunity for the public. No numbers are available to predict the increase in number of anglers from the program, but an increase is expected. A component of the evaluation is monitoring the socio-economic effects of squawfish management activities.

Recreational Concerns. Squawfish management is not expected to interfere with existing recreational activities on the water and at launch sites. A fishing platform will be constructed in a boat restricted zone at the Dalles Dam. Because the platform will be located in an area restricted to boat access, no potential interference with recreational interests is anticipated. During the 1990 sport reward fishery, few conflicts at boat launch sites such as congestion on ramps or on the water occurred. Late in the summer, there is a potential for interaction between sport anglers and windsurfers and jet- and water-skiers. Long-line commercial angling gear and sport fishing gear sometimes became entangled with sport anglers during the 1990 commercial fishery test. Setting fishing times, areas, and depths-of-sets for commercial anglers would separate commercial and sport anglers and minimize potential conflicts with recreation fisheries. Ongoing monitoring and evaluation will be conducted to direct management of this program and to ensure conflicts with these and other recreational activities are minimized.

The preferred alternative will not affect any National Trails or Wilderness areas, or any State designated parks or natural areas. The Program activities will take place within the Columbia Gorge National Scenic Area. Recreation effects will be limited to minor increases in the number of anglers and commercial fishing boats on the reservoirs. These minor increases will not be significant and should not effect the scenic area.

3.5 WILDLIFE AND RIPARIAN VEGETATION

Riparian/wetland plants surround the reservoirs in the Columbia River Basin. Riparian/wetland plant communities have very high vegetation and wildlife value. Habitat types range from sand dunes to various types of wetlands. Deer, beaver and other aquatic and terrestrial furbearers, small mammals, waterfowl, upland game birds, reptiles, and amphibians are among the common year-round users of riparian/wetland areas. Wintering elk and moose may use these areas around the reservoirs.

Along some reservoirs, changing water levels and shoreline erosion limit vegetation growth. Slides and wave action continuously remove soil and plant materials.

The preferred alternative would not affect any vegetation. No new facilities requiring construction are planned, and no listed or proposed endangered or threatened plant species or candidate plant species would be affected. The preferred alternative would comply with Executive Order 11990 (Protection of Wetlands), which requires Federal agencies to minimize the loss or degradation of wetlands. A variety of Federal, State, and local regulations affect construction and other activities in wetlands and adjacent areas. Sections 401 and 404 of the Clean Water Act and Section 10 of the River and Harbor Act

are the principal Federal laws that regulate activities in wetlands. The primary state regulations affecting development in and near wetlands include the Shoreline Management Act, Hydraulic Code, and the Washington State Environmental Policy Act. This program will not affect any wetland or adjacent areas and complies with these regulations.

3.6 ECONOMY

The dams on the Columbia and Snake rivers provide power and stored water for many industries in the Pacific Northwest. The economy of the Pacific Northwest is heavily resource-based. Lumber, wood products, pulp and paper, and metal (principally aluminum) production industries rely heavily on historically cheap hydroelectric power produced by these dams. The size and extent of the river systems allow large withdrawals for irrigation, a critical economic factor for agriculture, particularly in central and eastern Washington, eastern Oregon, and Idaho. The Columbia River Basin supports anadromous fish stocks, a resource important for the substantial recreation and economic value of the sport and commercial fisheries and for the high cultural and religious value to Columbia River Basin Tribes and others. The river systems are also economically important in providing multiple recreation opportunities (including boating, swimming, fishing, and windsurfing) and scenic tourist attractions, including the nationally valued Columbia River Gorge and Hell's Canyon, the nation's deepest river gorge. The river systems provide economic support for trade, providing transportation for goods into the interior of the Pacific Northwest.

The proposed program will not affect established industries or water used for agriculture, recreation, or power generation.

Regulations pertaining to "food fish" prevent "wanton waste" of northern squawfish and requires utilization once harvested (Oregon Wildlife and Commercial Fishing Codes 1987-1988). Several end uses for squawfish are being studied to ensure that squawfish caught are used. Test marketing in Asian markets and restaurants in Portland and Salem, Oregon, show good marketing potential in these areas if products are modified. Customers were positive about the squawfish's taste and texture, but were unfamiliar with the fish. The boniness of the fish may hamper marketing. Restaurants and markets have shown interest in a deboned product for fish cakes and fish balls. A deboned, minced product has the greatest potential for sustained market acceptance in both restaurants and retail stores.

The name "northern squawfish" does not appear to be a hindrance to marketing in the Asian market, but may be a problem if squawfish are marketed outside the Asian community. Identification and development of alternative, more palatable market names are being explored with the Food and Drug Administration. Alternate names have been used for other fish and have encouraged human consumption.

Harvested squawfish are also being tested as fish meal and food for other animals, as fertilizer, and as crab and crayfish bait. The use of northern squawfish as bait is acceptable but is a low-valued use. Liquid fertilizer base is a potential large-volume use of squawfish. Inland Pacific Fisheries also showed an interest in experimenting with squawfish fillets to be minced and frozen for human consumption.

Transportation of squawfish to these markets was not a particular problem. The squawfish were able to resist stresses of moving when handled properly. Squawfish skin mottles within one day after death and may be a cosmetic disadvantage to marketing. Costs incurred transporting live fish to market suggest delivering live fish is not cost-effective. Retail selling price was not sensitive to live as compared to dead-iced fish form. Researchers concluded that these potential uses make it possible to use all harvested fish.

Squawfish were tested for pesticides (PCBs, chlordane, DDT derivatives) and heavy metals (mercury, aluminum, lead, arsenic). Both organic and inorganic contaminant testing results indicate that northern squawfish is suitable for human consumption. Tests for dioxin accumulation are underway; results will be available in April 1991.

A commercial fishery designed to reduce squawfish populations could be profitable. Declining catches and fluctuating market prices may discourage commercial anglers after an initial "boom" period during the opening of a fishery to commercial harvest. There has been considerable commercial nongame species harvest in the Columbia River for human consumption and other protein supplementation markets. Carp, steelhead, salmon, American shad, eulachon, white sturgeon, and the Pacific lamprey are or have been harvested successfully. Profitability depends on market conditions and consumer demand.

Approximately $11,000 was awarded in the 1990 sport reward fishery. Estimates for an extended fishery are between $500,000 to $750,000 per year awarded to sport anglers participating in this fishery. This action may bring more recreation dollars to local merchants who provide services or supplies to anglers. This will have a minor positive effect on the local economy.

3.7 AIR QUALITY

National Ambient Air Quality Standards are established by the U. S. Environmental Protection Agency. The Federal Clean Air Act required EPA to: (1) identify pollutants that may endanger public health; (2) issue air quality criteria documents to reflect the latest scientific information about the effects these pollutants have on human health or welfare; and (3) set primary and secondary standards for these pollutants. The primary standards are required to protect the public health with an adequate margin of safety, and secondary standards protect the public welfare.

The Washington State Department of Ecology is responsible for air quality management. Its Air Program carries out mandates of the Clean Air Act for the State.

The existing air quality throughout the basin considered for this program is good to excellent. All potential areas for program implementation have air quality that falls within National Ambient Air Quality standards.

All expected air pollutant emissions would be short-term. There may be an increase in motorized boats on and traffic to reservoirs for the sport

fishery, creating additional vehicle and boat exhaust emissions (carbon monoxide, volatile organic compounds, nitrogen oxides, sulfur oxides, and particulate matter), but the increase would be insignificant. The commercial and dam angling fisheries also may increase automobile and boat emissions. Due to the minor amount of emissions generated by this program, no impacts on air quality are anticipated.

3.8 SOLID WASTE

Sanitation facilities for anglers exist at all reservoirs. Squawfish harvested will be marketed for human consumption, as food for fish and other animals, as fish meal, as fertilizer, and as crab and crayfish bait. All harvested squawfish will be used. Other fish caught incidentally will be released. An increase in solid waste is not expected. No hazardous waste will be generated.

3.9 NOISE

Existing ambient noise levels at the reservoirs are typical for rural to semiurban locations and range from 40 to 60 dBA. This program could affect noise levels due to additional boats on the reservoirs. Effects will be short term, limited to the fishing season, and insignificant. Because additional activities are expected to be minor, impacts should be minimal and not exceed Federal Interagency Committee on Urban Noise or Environmental Protection Agency noise guidelines, developed because of the Noise Control Act, 42 U.S.C.A. § 4901 et seq., 1972.

3.10 CULTURAL RESOURCES

Several Federal laws and regulations have been promulgated to protect the nation's historical, cultural, and prehistoric resources. These include the National Historic Preservation Act, the Archeological Resources Protection Act, the American Indian Religious Freedom Act, the National Landmarks Program, and the World Heritage List. These regulations safeguard historical and archeological resources and religious sites and ceremonial rites of American Indians.

Pursuant to the National Historic Preservation Act, the effects on historical, cultural, or archeological resources of any Federal undertaking must be evaluated. No land disturbing activities are proposed. Existing facilities will be used. The squawfish lacks religious or cultural significance to Tribes in the Columbia River Basin. Squawfish harvest is not expected to affect any cultural resources.

CHAPTER 4

CONSULTATION, REVIEW AND PERMIT REQUIREMENTS NOT ALREADY ADDRESSED

4.1 NATIONAL ENVIRONMENTAL POLICY ACT

This environmental assessment was prepared pursuant to the National Environmental Policy Act (42 U.S.C.A. § 4321 et seq.) and implementing regulations, which require Federal agencies to assess the impacts proposed actions may have on the environment. Using this information, a determination will be made either that the proposal will affect the environment significantly and an environmental impact statement is required, or the proposal will not have significant impacts and a Finding of No Significant Impact (FONSI) will be prepared.

4.2 REQUIREMENTS NOT APPLICABLE TO THIS PROPOSAL

In addition to the responsibilities under NEPA, Federal agencies are required to carry out provisions of many other Federal environmental laws. Many do not apply to this proposal because the proposal will not affect the area of concern in the individual laws. Subject areas and laws are listed below.

4.2.1 Farmland Protection

The Farmland Protection Policy Act (7 USC 4201 et seq.) directs Federal agencies to identify and quantify adverse impacts of Federal programs on farmlands. The Act's purpose is to minimize the amount Federal programs contribute to unnecessary and irreversible conversion of agricultural land to non-agricultural uses. This program will not affect any farmland.

4.2.2 Permits for Structures in Navigable Waters

The construction, rehabilitation, or removal of structures in navigable waters requires Federal and State permits. Federal permits are issued by the U. S. Army Corps of Engineers in accordance with Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. This project will not require construction, removal, or rehabilitation of any structures in navigable waters.

4.2.3 Permits for Discharges Into Waters of the United States

A national pollution discharge elimination system permit is issued if any pollution is discharged into the waters of the United States. This program will not require any discharges into the water.

4.2.4 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA), 42 U.S.C.A. § 6901 et seq., was passed in 1976 and amended several times. This legislation regulates the

handling, storage, and disposal of solid and hazardous waste. No chemicals or waste products will be used or produced.

4.2.5 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C.A. § 136 et seq., was passed in 1982 and has since been amended several times. The Act regulates the handling and application of pesticides. No pesticides will be used in this program.

4.2.6 Toxic Substances Control Act

The Toxic Substances Control Act, 15 U.S.C.A. § 2601 et seq. regulates the manufacture and, to some extent, the use of toxic substances. No toxic substances will be manufactured or used in this program.

4.2.7 Energy Conservation at Federal Facilities

The Energy Conservation Policy, 42 U.S.C.A. § 8241 et seq., was passed in 1978. The goal of this legislation is to "promote the use of energy conservation, solar heating, and cooling, and other renewable energy sources in Federal building." No Federal buildings will be constructed for this program.

4.2.8 Global Warming

This program will not generate gases that may affect global warming in significant amounts.

CHAPTER 5

CONSULTATION AND COORDINATION

Many individuals were contacted as this report was prepared. Individuals and their respective agencies or businesses are listed below.

Archeological and Historic Services - Jerry Galm
Bonneville Power Administration - Kevin Ward, Bill Maslen
Columbia River Inter-Tribal Fish Commission - Phil Mundy, Roy Beaty
Oregon Department of Fish and Wildlife - Tony Nigro, Steven Vigg, Dave Ward
Oregon State University - Susan Hanna
U.S. Fish and Wildlife Service - Diana Hwang, Denny Lassey
U.S. Army Corps of Engineers - Gary Johnson, Chip Pierson
Washington Department of Fisheries - Rod Woodin, Evan Jacoby, Bruce Sanford
Washington Department of Wildlife - Greg Hueckel, Dan Wyckoff

Regulatory Review Addressees:

Burns-Paiute Indian Colony - Larry Richards
Coeur d'Alene Tribe - Ernie Stensgar
Columbia Basin Fish and Wildlife Authority - Dr. John R. Donaldson
Columbia River Inter-Tribal Fish Commission - Roy Beaty, Rob Lothrop, Ted Strong
Colville Confederated Tribes - Jerry Marco, John Smith
Confederated Tribes and Bands of the Yakima Indian Nation - Bill Bradley, Levi George, Sr., Jeanette Lee
Confederated Tribes of the Umatilla Indian Reservation - Don Sampson
Confederated Tribes of the Warm Springs Reservation of Oregon - Eugene Greene, Sr.
Fish Passage Center - Michele DeHart
Idaho Department of Fish and Game - Bert Bowler, Jerry Conley, Steve Pettit
Kalispel Tribe - Glen Nenema
Kootenai Tribe of Idaho - Velma Bahe
Montana Department of Fish, Wildlife, and Parks - K.L. Cool, Chris Hunter
National Marine Fisheries Service - Brian Brown, Chris Ross, Rolland Schmitten
Nez Pierce Tribe of Idaho - Virgil Holt, Si Whitman
Oregon Department of Fish and Wildlife - Ron Boyce, Doug DeHart, Randy Fisher, Frank Young
Salish-Kootenai Tribes - Michael Pablo, Rhonda Swaney
Shoshone-Bannock Tribes of Fort Hall - Sue Broderick, Kesley Edmo
Shoshone-Paiute Tribes of the Duck Valley Reservation - Edith Manning
Spokane Tribe of Indians - Joe Flett
UCUT Fisheries - Allan Scholz
Umatilla Confederated Tribes - Kathryn Brigham, Elwood Patawa
Upper Columbia United Tribes - Dr. Allan Scholz
U.S. Fish and Wildlife Service - Fred Olney, Marv Plenert, Craig Tuss
Warm Springs Confederated Tribes - Eugene Greene, Zane Jackson
Washington Department of Fisheries - Joe Blum, Kahler Martinson, Rod Woodin
Washington Department of Wildlife - Jerry Neal, Jim Nielsen, Curt Smitch

CHAPTER 6

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