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FINAL

ENVIRONMENTAL ASSESSMENT

SQUAWFISH MANAGEMENT PROGRAM

DISCLAIMER

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EXECUTIVE SUMMARY
ENVIRONMENTAL ASSESSMENT FOR THE SQUAWFISH MANAGEMENT PROGRAM

PURPOSE AND NEED OF PROPOSED ACTION

Bonneville Power Administration (BPA) proposes to decrease the number of northern squawfish (Ptychocheilus oregonensis) in reservoirs in the Columbia River system. The goal of the Squawfish Management Program is to reduce losses of outmigrating juvenile salmon and steelhead (salmonids) to northern squawfish predation. The objective is to reduce the number of northern squawfish that feed on juvenile salmonids (smolts) by 10 to 20 percent to alter the age and size structure of the northern squawfish population. The hypothesis, based on computer modeling, indicates that sustained northern squawfish harvest (5 to 10 years) and the resultant population restructuring may reduce losses of juvenile salmonids to predation by up to 50 percent or more within 10 years. The proposed action would target northern squawfish 11 inches and longer, the size in which northern squawfish begin preying significantly on juvenile salmonids.

PROPOSAL

BPA proposes to fund three types of fisheries to harvest northern squawfish. BPA also proposes to fund monitoring activities of these fisheries to determine whether desired or other results occur.

The three fisheries methods proposed are: (1) commercial Tribal fishing; (2) sport reward fishing; and (3) fishing from restricted areas of each dam ("dam angling"). These fisheries were tested in 1990 and 1991. 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 northern squawfish caught. Dam angling would be carried out by technicians hired by the States or Tribes to fish for northern squawfish from restricted areas on the dams. Additional efforts to harvest northern squawfish from the restricted zones around dams or other areas where northern squawfish are concentrated may also be undertaken by State and Federal fishery agencies and Tribes.

BPA proposes to fund northern 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 Hells Canyon Dam at the head of Lower Granite Reservoir. The program would be implemented as a demonstration for 5-10 years. If effective, it would be implemented on a sustained long-term basis under BPA funding. In the future, regional entities may plan northern squawfish management in the Columbia River from Priest Rapids Dam to Chief Joseph Dam (i.e., non-Federal reservoirs). Expanding the program would be dependent on funding, access for fishing from restricted areas on non-Federal dams, and results of initial northern squawfish management efforts.

Monitoring will include evaluating how populations of northern squawfish and other predators respond to the reduction in numbers of northern squawfish. Ongoing research addresses how juvenile salmonids are selected as prey, developing and testing ways to remove predators, and protecting juvenile salmonids from predators. Ideally, changes in juvenile salmonid survival and adult production would be the basis to determine the success of the program. Because changes in juvenile fish survival or adult production are not attributable to a specific causative factor, the effectiveness of northern squawfish management would be assessed indirectly through observed changes in the age/size structure of the northern squawfish population, response of the predator fish community, and computer modeling.

ENVIRONMENTAL ISSUES

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

Incidental Catch. In tests of the proposed fisheries, low numbers of fish other than northern squawfish were caught through incidental catch. No significant injury or mortality level could be attributed to incidentally caught fish. However, information is limited, therefore, monitoring and evaluation of incidental catch will be ongoing to further document and assess impact of incidental catch, and to provide a basis for program management.

The Squawfish Management Program includes monitoring and oversight of incidental catch of species other than northern squawfish. Information collected would include gear type, date and location of catch, numbers of fish caught by species, fish condition, and general conditions under which the catch occurred.

Concerning impacts on Columbia Basin salmon listed or petitioned for listing under the Endangered Species Act, the Squawfish Management Program would minimize any impact to or handling of salmon and other incidentally caught species. If any activity results in the incidental catch of salmonid species, appropriate action would be taken to minimize any further catch. If necessary, the activity resulting in the incidental catch of listed or petitioned stocks may be temporarily terminated.

Intraspecific Concerns. Once northern squawfish are removed, the remaining northern squawfish population could overcompensate for reduced numbers of large northern squawfish. Consumption rates and growth of remaining northern squawfish could increase if northern squawfish numbers are reduced, but strong compensation is not anticipated. If removing northern squawfish is not sustained, predation may be aggravated if removal restructures the population and increases the number or size of northern squawfish. Monitoring and evaluation would be planned to determine the effects of harvest on northern 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 and cannot be predicted. Purposes of the monitoring and evaluation associated with this program include gathering

data on how northern squawfish and other predators respond to the program, delineating potentials for change, and adjusting the program to the predators' response.

Recreation. Northern squawfish management is not expected to interfere with existing recreation activities on the water or at boat launch sites. Setting fishing times, areas, and depths-of-sets for commercial anglers would separate commercial and sport anglers and minimize potential conflicts with recreational fisheries. Ongoing monitoring and evaluation would be conducted to direct management of this program and minimize conflicts with these and other recreational activities.

Biological Risk. There is generally regional agreement that there is little biological risk of jeopardizing resident fish communities by harvesting northern squawfish. How northern squawfish and other species would compensate for northern 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 the historic balance among juvenile salmonids and northern squawfish. Ongoing monitoring and evaluation would provide information to allow adaptive management of the program.

CONCLUSIONS

BPA anticipates that any negative effects of the Squawfish Management Program, as summarized above, would be temporary and minor. Evaluation and monitoring would be planned to determine how northern 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. Northern squawfish management would be intended to help restore a historic balance among juvenile salmonids and northern squawfish. Implementation of this program could reduce the number of northern squawfish that feed on juvenile salmonids. As a consequence, there could 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 anticipated 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 Federal Columbia River Power System through a Squawfish Management Program. The goal of this program is to reduce losses of outmigrating juvenile salmon and steelhead (salmonids) to northern squawfish predation. The objective is to reduce the number of northern squawfish that feed on juvenile salmonids (smolts) by 10 to 20 percent and alter the age and size structure of the northern squawfish population. The proposed action would target northern squawfish 11 inches and longer, the size in which northern squawfish begin preying significantly on juvenile salmonids.

The Squawfish Management Program is designed to reduce the effects of predation by northern 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, of which the northern squawfish is the predominant one. Reducing the number of northern squawfish in the river system is intended to increase the survival of juvenile salmonids and thus increase the number of adults returning from the ocean to spawn.

The hypothesis, based on computer modeling, indicates that sustained northern squawfish harvest and the resulting population restructuring may reduce losses of juvenile salmonids to predation by 50 percent or more within 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 northern squawfish.

BPA would harvest northern squawfish by funding three fisheries:

- Sport fishing for northern squawfish open to all appropriately licensed anglers and encouraged through a reward for each northern 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 northern squawfish from restricted areas on the dams.

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

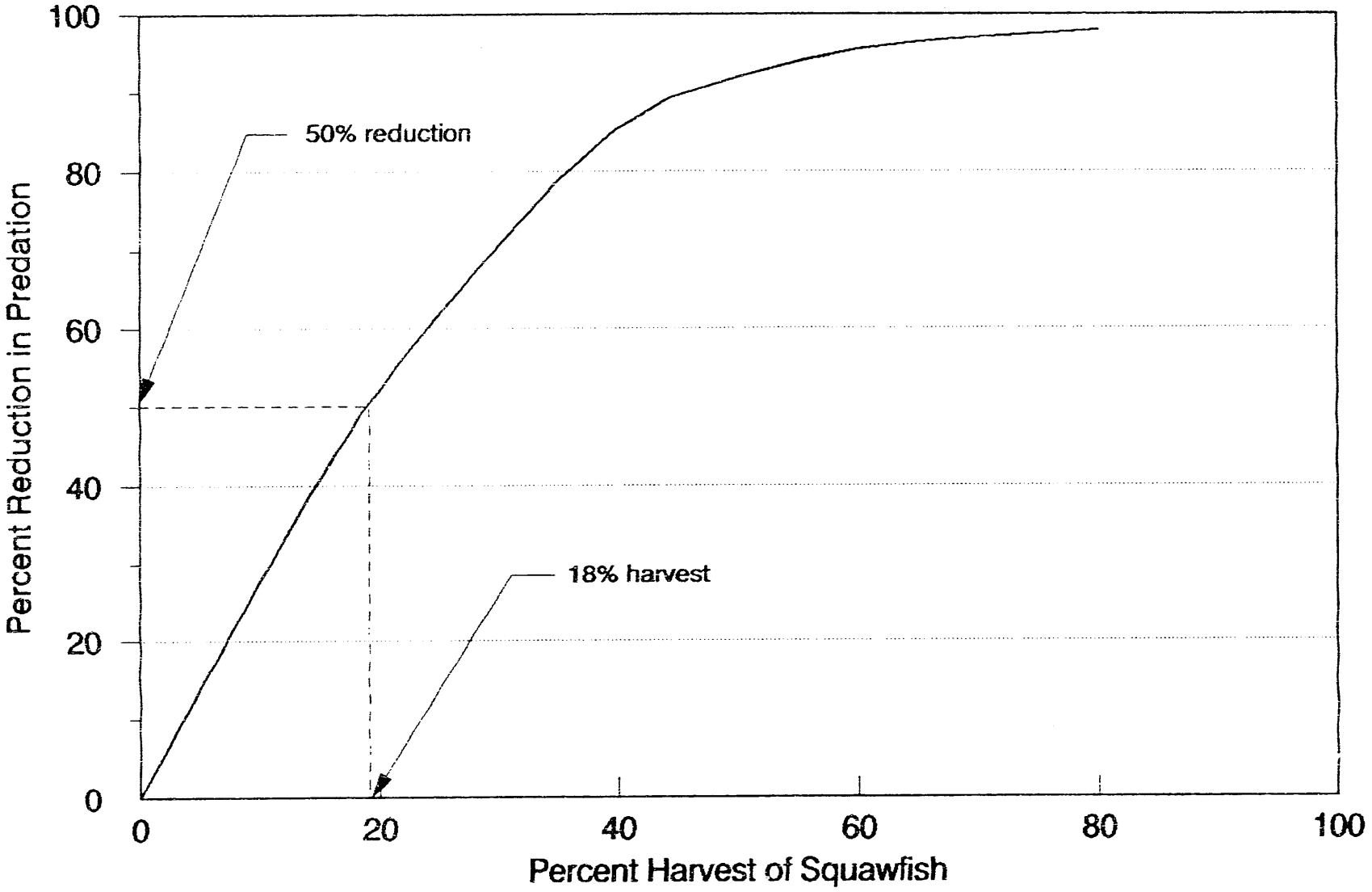


Figure 1. Potential reduction in predation resulting from Squawfish Management
(Adapted from Rieman and Beamesderfer 1988)

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 Hells Canyon Dam. For 5-10 years research and monitoring would be conducted to determine the effects of northern squawfish harvest on fish communities and effectiveness at reducing predation mortality on salmonids. If effective, BPA would continue to fund on a sustained long-term basis. 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 northern 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 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

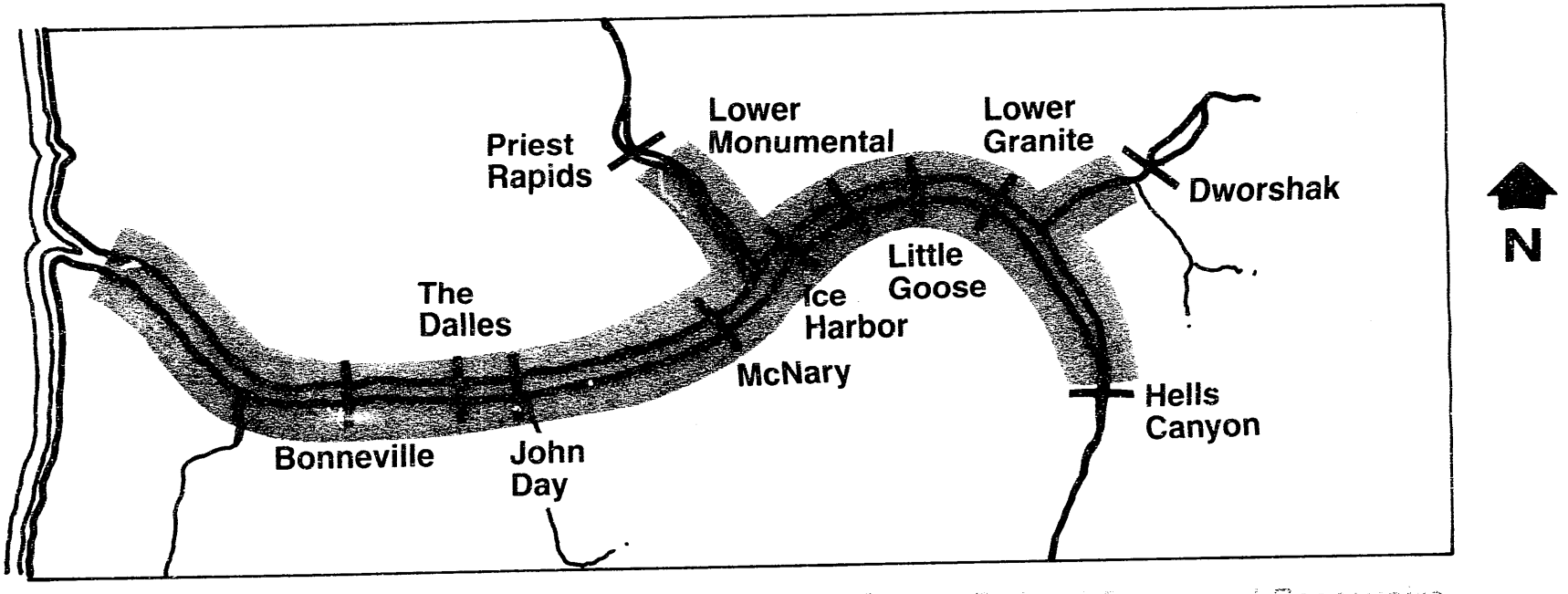
Sections 200 and 400 of the Northwest Power Planning Council's (Council) 1987 Columbia River Basin Fish and Wildlife Program (Program) identified reservoir mortality as an important limiting factor to reaching the Council's goal of doubling adult anadromous fish runs. Predation by resident fish in reservoirs 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" (Measures 403(d)(1)).

BPA has funded indepth predator-prey research in the John Day Reservoir since 1982 (Poe and Rieman, eds. 1988). Rieman et al. (1991) suggested that predation is the major component of unexplained mortality and can easily account for previously unexplained losses. They estimated approximately 2.7 million juvenile salmonids are preyed on annually by northern squawfish, walleye (Stizostedion vitreum), and smallmouth bass (Micropterus dolomieui) in the John Day Reservoir, or 14 percent of juvenile salmonids entering the reservoir. Northern squawfish were responsible for 78 percent of the total loss.

One method of protecting juvenile salmonids from the cumulative effects of reservoir and dam passage is to collect and transport the juveniles around the dams. Juvenile salmonids are collected at Lower Granite, Little Goose, and McNary Dams and transported by barge or truck to below Bonneville Dam and then released into the Columbia River. In-river migrants (nontransported fish) are exposed to predation in-river, as are the transported fish prior to arriving at transport sites and following release below Bonneville Dam.

Reducing predator numbers could improve juvenile fish survival (Beamesderfer et al. 1990). Rieman et al. (1991) reported that efforts to reduce predation could produce substantial benefits in salmon and steelhead production. This and other measures to decrease juvenile mortality would contribute to the Council's goal of doubling returning adult fish runs.

Columbia River Basin



Columbia and Snake Rivers Federal Dams and 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 Northwest Power Act also gave 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, are released into streams and lakes, where they travel to the ocean to 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, increase river water temperatures, and extend the time it takes smolts to travel to the sea. Fish passage at dams also results in disorientation, stress, and injury. All these factors may contribute to potential vulnerability to predation (Rieman et al. 1991).

The lake environment created by the dams is a favorable environment for some native and introduced fish predators. The number of predator species has increased since development of the hydrosystem. The primary fish predator is the northern squawfish. Researchers believe predation is more important now than before dams were built, and it has contributed to declining fish runs (Rieman et al. 1991).

Northern squawfish are indigenous to the Columbia River Basin and live throughout the system. An adult northern squawfish can consume several juvenile salmonids per day (T. Poe, U.S. Fish and Wildlife Service, personal communication) and account for approximately 80 percent of salmonids lost to predators in the John Day Reservoir (Rieman et al. 1991). Northern squawfish congregate downstream of McNary Dam (Beamesderfer and Rieman 1991) and take advantage of the increased vulnerability of salmonids. Similar observations have been made at other mainstem dams (Petersen et al. 1990; Nigro (ed.) 1990; B. Maslen, personal communication). If fewer northern squawfish existed in the system, juvenile salmonid losses could be reduced assuming numbers or consumption rates of other predators did not increase (Beamesderfer et al. 1990).

CHAPTER 2

ALTERNATIVES CONSIDERED

2.1 ALTERNATIVES CONSIDERED AND ELIMINATED FROM FURTHER STUDY

2.1.1 Predator Control

Various alternatives of predator control were studied (Poe et al. 1988) to determine the feasibility of decreasing the size of predator populations by various means. 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. The following criteria were used to evaluate the alternatives:

- 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 effects.
- 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, excerpted from Poe et al. (1988) Evaluation of Predator Control Measures, shows the alternatives evaluated and their rankings. This EA addresses only measures identified as "predator control"; prey protection measures are outside the scope of this EA.

As Table 1 shows, the two predator control measures that received rankings with the highest potential were (1) netting and trapping, and (2) changing 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 often wait. Traps could be used only in backwaters and protected areas where there are fewer predators. Because of its limited use, this measure is being considered for special applications such as for restricted zones around dams. The second alternative with high potential, changing harvest regulation, would encourage commercial and sport harvest of northern 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 considered was a specific toxin to northern squawfish called Squoxin (see Rulifson 1984). Squoxin, discovered at the University of Idaho, is lethal to northern 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 on salmonids to determine latent mortality. 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 resistance from the public to treating fish chemically and resistance from the scientific community 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 is not considered in this EA.

All other alternatives shown on Table 1 had moderate or low potential to reduce predation and are not considered in this EA.

2.1.2 Harvest Regulations

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

Gear types were chosen to be tested based on their adaptability to commercial vessels used on the Columbia River and adjacent regions and their suitability to the physical environment of the Columbia River reservoirs (Mathews et al. 1989). Figures 3A-D (Gear Types) show the gear types: (1) purse seine; (2) long-line; (3) gill nets; and (4) baited pots.

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 northern squawfish. Northern squawfish composed 72 percent of fish caught by long-line, and incidental catch, primarily channel catfish and white sturgeon, were usually alive and viable at release. Purse-seine, gillnet, and baited pot gear types were eliminated from further consideration for commercial harvest of northern squawfish because of low catch rates of northern squawfish, incidental catch of nontarget species, and relatively high operation and maintenance costs. See Mathews et al. (1989) for additional detail.

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 82 percent of the incidental catch and 23 percent of total fish caught. Most were hooked in outer mouth parts and could be released unharmed. But 5 percent of the white sturgeon and 14 percent of the channel catfish died after being captured and held (Mathews et al. 1989). Smolts were the most effective bait used. (Dead smolts were obtained from the McNary Dam juvenile fish bypass and sampling

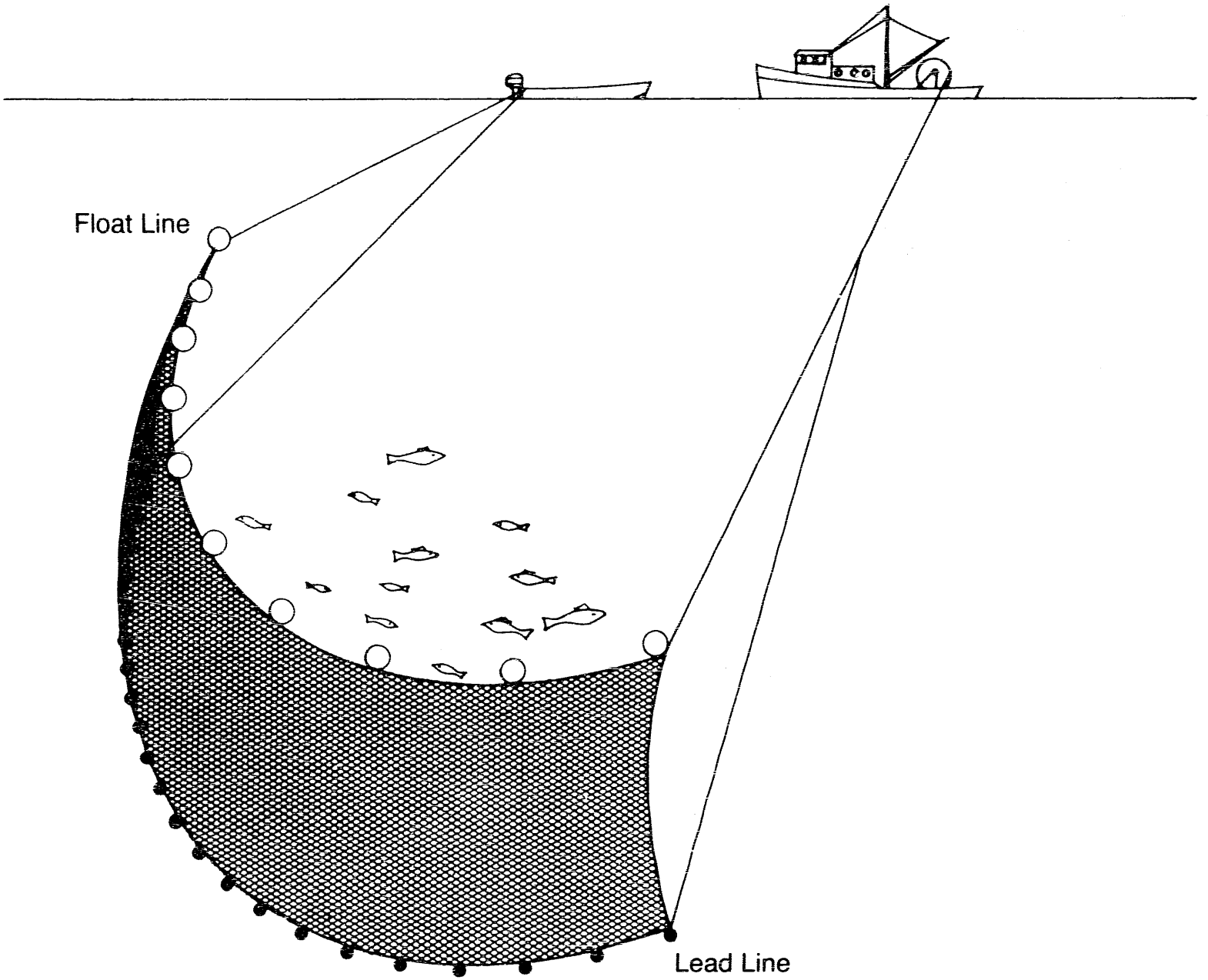


Figure 3-A. Purse Seine

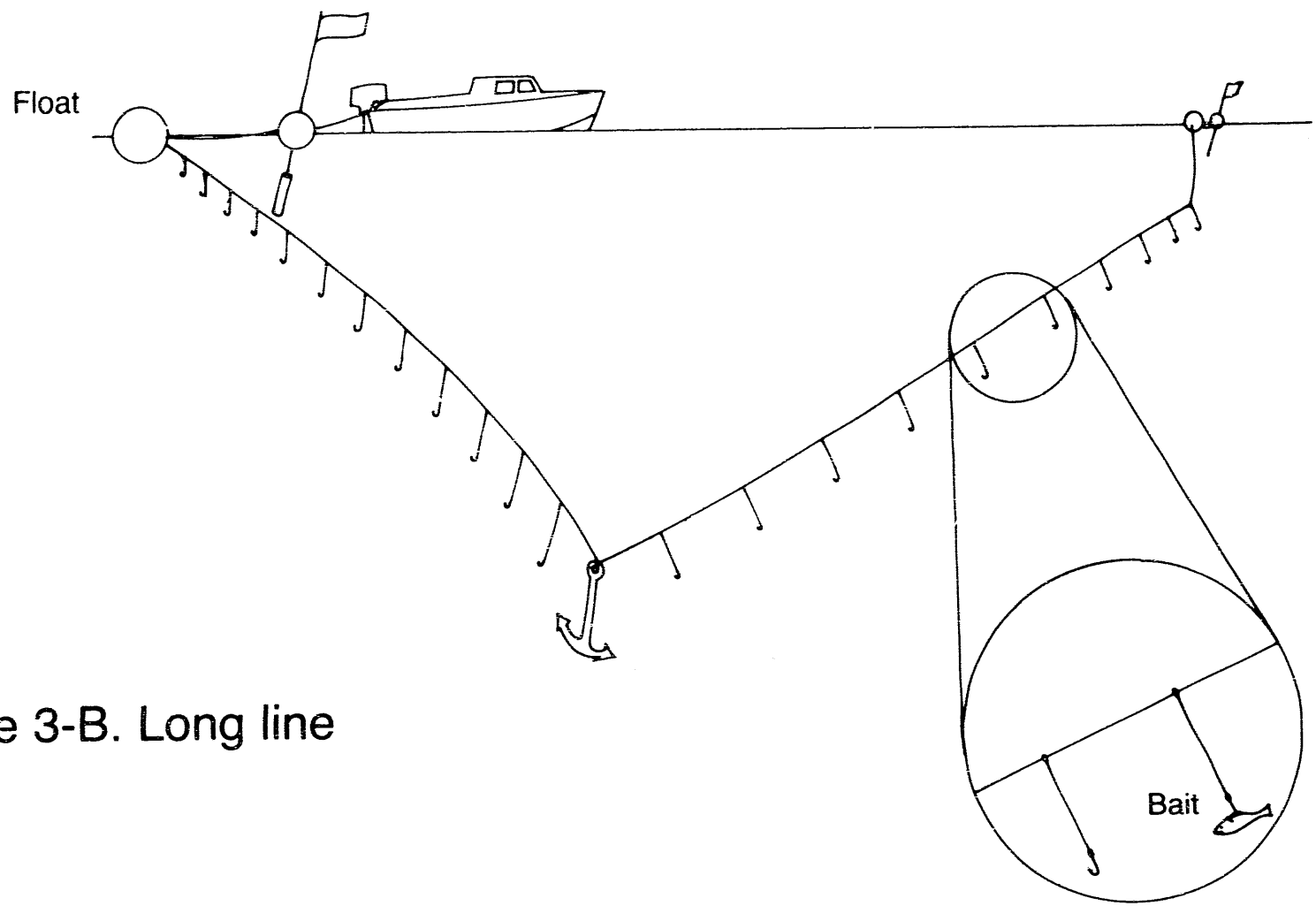


Figure 3-B. Long line

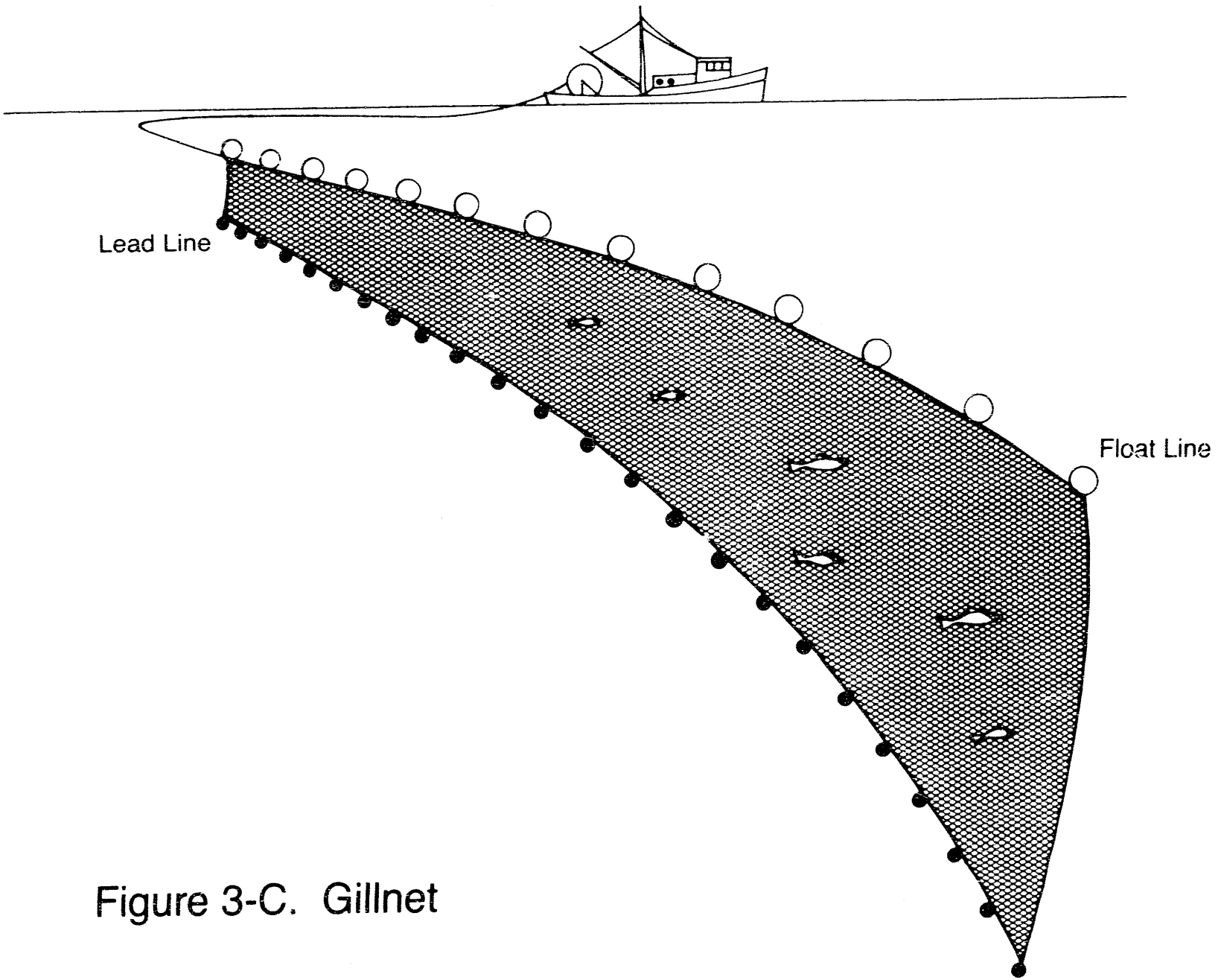


Figure 3-C. Gillnet

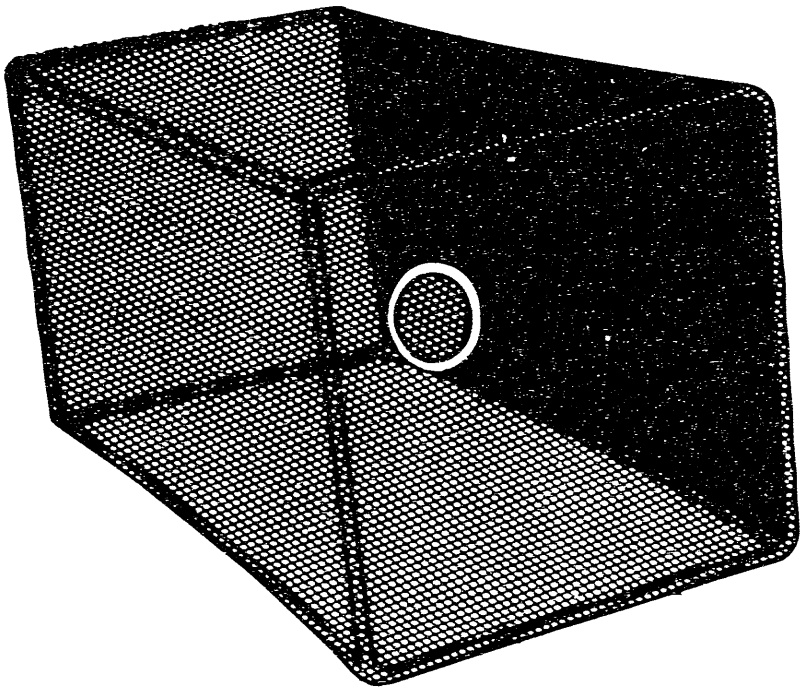


Figure 3-D. Pot Gear

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 northern squawfish and suckers. Long-lines became entangled with sport fishing gear in some locations. Specifying and publicizing fishing times, areas, and depths-of-sets can minimize potential conflicts with sport fishery gear.

Angling techniques are effective on northern squawfish, and are probably capable of achieving approximately 20 percent catch exploitation rate throughout the project area if this alternative could be economically implemented (Rieman and Beamesderfer 1990). However, use of sport and commercial fisheries to reduce predator fish is not well documented (Poe et al. 1988; Hanna 1989). The purpose of the test fishery in the John Day Reservoir was to evaluate the feasibility of implementing the sport and commercial fishery on a small scale.

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

2.2 PROPOSED ACTION

Based on findings of the studies for evaluating the predator control measures (Poe et al. 1988; Vigg and Burley 1989), selection of gear types for commercial fishing of northern squawfish (Mathews et al. 1989), and experience from sampling northern squawfish in previous studies (A. Nigro, Oregon Department of Fish and Wildlife, personal communication), the preferred 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 (Nigro, (ed.) 1990).

Commercial fishing would be implemented by Tribal anglers in the Columbia River from Bonneville Dam to McNary Dam. This fishery would be restricted to Tribal anglers using long-lines.

A sport reward fishery would be established from below Bonneville Dam tailrace to Priest Rapids tailrace on the Columbia River and to Hells Canyon Dam tailrace on the Snake River. This program would be open to all appropriately licensed anglers. Reward would be $3 per northern squawfish. This reward amount could be increased in the future as necessary to achieve program objectives. In the future, regional entities may plan northern 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 northern squawfish management efforts. Check stations would be located throughout the Federal hydrosystem, with at least one check station in each reservoir.

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.

Evaluation and monitoring would be an integral part of this program. For ongoing program monitoring, State and Federal agencies would collect biological data for BPA. 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 northern squawfish, prey protection measures, and other northern squawfish harvest techniques (including traps and electroshocking). Ultimately, juvenile salmonid survival and adult production would determine the success of the program.

Evaluation of the Squawfish Management Program would consider two factors, biological and socioeconomic. Biological evaluation is designed to assess fish community structure and function. Rieman and Beamesderfer (1990) indicated they would not expect a sharp increase in reproduction levels in northern squawfish populations to compensate for those removed. Rieman and Beamesderfer stated they did not feel the effects of northern squawfish removal on other fish predator species could be predicted, however. They strongly recommended research to accompany a removal program to assess compensation within the predatory fish community. The effect of harvest of northern squawfish would be evaluated through computer modeling based on catch and biological data from the harvest fisheries as well as research to assess other factors such as cause-effect relationships and prey selection.

The other aspect of biological evaluation is determining the effectiveness of northern squawfish management at reducing reservoir mortality attributable to predation. Ideally, evaluation would be based on changes in juvenile salmonid survival or adult production attributable to northern squawfish management. But the region does not possess the technological ability to make those assessments. Evaluation would be based on: (1) rate of harvest of northern squawfish; (2) changes in the age/size structure of the northern squawfish populations; (3) consumption of juvenile salmonids by northern squawfish and other resident fish predators; and (4) computer modeling or predator-prey dynamics and juvenile fish survival.

Socioeconomic evaluation is designed to monitor the social aspects of implementation of the program. Included are interactions with other users of the river resource and impact on local communities, responsible use of harvested northern squawfish, and process-related considerations for program implementation. The latter encompasses legal, institutional, and regulatory considerations.

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

2.3 NO-ACTION ALTERNATIVE

As required under the National Environmental Policy Act, the No-Action Alternative has been considered as a possible alternative. The No-Action Alternative would mean no action would be undertaken to increase juvenile fish

survival by managing northern squawfish (i.e., no action to reduce northern squawfish numbers). While other actions to improve fish survival may indirectly affect northern squawfish predation on salmonids, direct removal of northern squawfish would not occur, northern squawfish populations would remain largely unregulated, and northern 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 consideration for implementation in this document, but is used as the baseline to determine the proposed action effectiveness.

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 or affect land use practices.

The following is a brief description of the projects and reservoirs (Project Data and Operating Limits, U.S. Army Corps of Engineers) to be considered initially for northern squawfish management.

Bonneville Dam. Bonneville Dam was built on the Columbia River for power generation, navigation, and flood control. It is the farthest dam downstream on the Columbia River. It is also used for fisheries, recreation, and water quality. Bonneville Dam is one of four "run-of-the-river" dams operated for hydroelectric power generation, flood control, 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 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.

John Day Dam. John Day Dam, completed in 1971 for power generation and navigation, and is also used for fisheries, recreation, irrigation, and flood control. It is a run-of-the-river project. The reservoir, Lake Umatilla, is about 76 miles long, with a surface area of about 52,000 acres.

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 on the Snake River about 10 miles from the mouth, 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. It is a run-of-the-river project.

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 also is used for fisheries, recreation, irrigation, and water quality. It was completed in 1975. It is a run-of-the-river project.

Environmental Concerns. The proposed Squawfish Management Program would not have an effect on water used for power generation, irrigation, navigation, fisheries, recreation, or flood control. No water will be diverted or used. Because none of these reservoirs are 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 would be consistent with their plans and policies. Since this proposal does not change any land use, and would not affect shorelines or cause discharges to water, this proposal would be consistent with local plans and zoning.

In accordance with Executive Order 12372, this Environmental Assessment would 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 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 American 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 Lower Snake River must pass up to 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 within the fresh-water system. Resident fish include northern squawfish, trout (salmonidae), and warm water species such as the largemouth bass (Micropterus salmonides), bluegill (Lepomis machrochirus), and crappie (Pomoxis nigromaculactus).

The fish community in John Day Reservoir contains both resident and anadromous fish. This community is representative of the fish community of the Columbia River system (A. Nigro, Oregon Department of Fish and Wildlife, personal communication). 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 (Poe and Rieman (eds.) 1988). The John Day Reservoir had 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 (Stizostedion vitreum), smallmouth bass (Micropterus dolomieui), and channel catfish (Ictalurus punctatus) (Poe et al. 1991). Fish were the dominant prey group (by weight) for these species. Pacific salmon and steelhead (Oncorhynchus spp) juveniles were the most important food group for northern squawfish, 67 percent by weight. Salmon and steelhead juveniles were a lesser proportion for other predators: 33 percent for catfish, 14 percent for walleye, and 4 percent for smallmouth bass. Northern squawfish, smallmouth bass, and channel catfish also preyed on other fish, crustaceans, and insects, with crayfish being the second most important food by weight. In contrast, greater than 96 percent of the walleye diet is fish, mostly prickly sculpin and suckers. Insects were frequently consumed by walleye but made up little of the bulk in their diet.

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 found that loss and mortality estimates of salmonids varied from month to month (Rieman et al. 1991). Changes in the environment or prey characteristics can have an important influence on fish losses. Prey consumption may vary as prey number varies or by season. Temperature influences predator metabolic demands and consumption rates for northern squawfish. That is, the higher the temperature, the greater the metabolic rate and consumption rate. Because of this variability, mortality rates 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, which migrate primarily during the summer when the water is warmer.

Size of prey selected by northern squawfish may also be an important factor in reducing survival of smaller migrants (Poe et al. 1991). Fall chinook salmon may be more vulnerable to predators because they move slowly through the reservoirs and are smaller than spring chinook or steelhead.

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 (Vigg et al. 1990; Petersen et al. 1990). By studying consumption of juvenile salmonids by northern squawfish and northern 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. This research also establishes a baseline for future evaluation of the effect of northern squawfish management (Vigg and Burley 1989).

Rieman and Beamesderfer (1990) used computer simulations to predict potential changes in predation by northern squawfish if northern squawfish were harvested. Their objective was to describe predation responses caused from sustained moderate or intensive predator removal. Their results showed the following:

(1) Northern 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 northern squawfish reproduction assumption used.

(2) The time required to achieve a 50 percent reduction in predation varied depending on the exploitation rate on northern squawfish. For example, a 50 percent reduction in predation was achieved in 10 years with exploitation rates between 15 and 25 percent, depending on the assumption on reproduction. Predation was reduced by 50 percent within 3 years with exploitation rates of greater than 30 percent, regardless of the assumption on reproductions.

(3) The computer model showed that if removal stops, northern squawfish populations recovered 90 percent of their original number in 6 to 30 years depending on the assumptions used for northern squawfish reproduction. If smaller northern squawfish or other fish respond to the void created by removing large northern 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 before coming to equilibrium.

These results suggest some risk in a control program that is not sustained. The rate of increase in predation following a stop in exploitation cannot be predicted with certainty (Rieman and Beamesderfer, 1990). The response is dependent on northern squawfish reproduction. In most eradication programs for other fishes, however, no reproductive compensation was found. Noting that northern squawfish are slow growing and exhibit low mortality compared with other species, Rieman and Beamesderfer (1990) concluded they would not expect strong compensation in recruitment of exploited northern squawfish stocks.

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 (Hanna and Pampush, 1990). 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 northern squawfish from an "unclassified" to a "food fish" in Washington State before full-scale implementation of a commercial fishery.

- Individual Tribes maintain their right to develop their own fishery management plans for northern 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.

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 would 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 would not participate 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 would be restricted for safety and security reasons. 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 northern squawfish in 1991 (Vigg et al. 1990). Efforts to reduce predation could produce substantial benefits to salmon and steelhead production (Rieman et al. 1991). Reducing predator numbers can cause changes in a predator's population structure (Beamesderfer et al. 1990). The change in population structure is the mechanism that would result in a reduction in predation. Limited but sustained exploitation would be a better alternative for northern squawfish management than intensive removals (Rieman and Beamesderfer 1990). Intensive removals of northern squawfish would be logistically difficult to execute. Sustained exploitation would be better for monitoring and managing the program. It would also incur less risk in terms of causing an undesirable effect on fish communities.

A reduction in northern squawfish predation may also benefit endangered or threatened listed or proposed Snake River anadromous stocks. Based on results

of computer modeling by BPA, a 50 percent reduction in northern squawfish predation at each reservoir in the lower Columbia and Snake Rivers may increase relative juvenile survival of Snake River spring, summer, fall chinook and sockeye within 10 years. This increase in juvenile salmonid survival for spring chinook, summer chinook, fall chinook, and sockeye originating upstream of Lower Granite Dam to below Bonneville Dam would be 14, 16, 34, and 16 percent respectively (NMFS Record 1991).

Benefits of northern squawfish management should be considered long-term (Beamesderfer et al. 1990). Based on computer modeling of predator-prey dynamics, researchers hypothesize that reducing northern squawfish numbers by 10-20 percent annually, on a sustained basis, may reduce predation by up to 50 percent within 10 years (Rieman and Beamesderfer 1990).

Incidental Catch Concerns. An important consideration in determining appropriate northern squawfish harvest fisheries and their management is the number of nontarget fishes caught (i.e., species other than northern squawfish). Data collected in previous years indicate relatively low numbers of nontarget species are caught in long-line and dam angling fisheries (Mathews et al. 1989; Mathews and Iverson 1990). In the case of salmonids, none were incidentally caught with long-line gear in 1989 and 1990; results were similar in 1991 (C. Willis, Oregon Department of Fish and Wildlife, personal communication). In 1990, a total of 19 salmonids were caught in the dam angling fishery conducted at five of the eight Federal dams (Nigro ed. 1990). In 1991, a total of 129 salmonids (90 juveniles and 39 adults) were caught in the dam angling fishery conducted at the eight Federal dams (B. Parker, Columbia River Inter-Tribal Fish Commission, personal communication).

Catch of nonsquawfish in the sport-reward fishery does not necessarily equate to incidental catch. Sport anglers are often targeting other species, including salmonids; northern squawfish are the incidental catch. Thirty-one steelhead/rainbow trout were returned by anglers to northern squawfish sport-reward fishery check stations in 1991 (C. Burley, Washington Department of Wildlife, personal communication). Additional information on salmonids caught by anglers participating in the northern squawfish sport-reward fishery is unavailable. As a result, surveys would be conducted in 1992, to obtain additional information on catch of salmonids and incidental catch of other species by anglers participating in the northern squawfish sport-reward fishery. The northern squawfish sport-reward fishery would be implemented consistent with appropriate State sport fishing regulations.

Incidental catch of nonsquawfish species occurs during index sampling (sampling for northern squawfish to determine abundance, consumption, age/size, fecundity, etc.). Results of 1990 index sampling incidental catch are reported in Nigro ed. (1990). Other research activities may also result in incidental catch of nonsquawfish species. Index sampling and other research activities would be managed to minimize incidental catch. All of these facilities would be coordinated closely with regional fishery interests, including the National Marine Fisheries Service, to determine appropriate management actions.

The Squawfish Management Program would include monitoring and oversight of all program activities as a basis for program management. One of the purposes of this monitoring would be to provide information on incidental catch of species other than northern squawfish. Information collected would include gear type, date and location of catch, numbers of fish caught by species, fish condition, and general conditions under which catch occurred.

With concern for impacts on petitioned or listed salmon in the Columbia Basin under the Endangered Species Act, activities associated with the Squawfish Management Program would be closely monitored by BPA and program implementers, discussed with regional interest including the NMFS, and appropriate actions taken to minimize any impact or handling of salmon, as well as other incidentally-caught species. As deemed necessary, based on discussions with the NMFS, the activity resulting in the incidental catch of listed or petitioned stocks may be temporarily terminated.

Intraspecific Competition. The northern squawfish population could respond to reduced numbers of larger members of their population. For example, consumption rates, reproduction, and growth could increase as a result of a reduction in northern squawfish numbers. Rieman and Beamesderfer (1990) concluded that strong compensation would be unlikely, but the benefit of northern squawfish management could be less than anticipated if compensation occurs. Manipulating the population would be necessary to understand the response (Poe and Rieman (eds.) 1988). Evaluation activities would include monitoring within the northern squawfish population that may result from northern squawfish management activities.

Interspecific Competition. In complex natural communities, reducing predation by one predator species could result in compensation by other predator species (Rieman and Beamesderfer 1990). In the Columbia River Basin, other resident fish predators include walleye, smallmouth bass, and channel catfish. Connolly and Rieman (1988) reported that strong compensation by walleye or smallmouth bass was not likely, but interactions among these fish populations are not predictable (Rieman and Beamesderfer 1990) and may reduce anticipated benefits of northern squawfish management. Program evaluation would be designed to address potential compensation within the resident fish community.

Biological Risk. Regional biologists generally agree there is little biological risk of jeopardizing fish communities as a result of implementing northern squawfish removal in the Columbia River Basin (B. Maslen, Bonneville Power Administration, personal communication). The proposed approach to northern squawfish management has been methodically developed based on relatively extensive research on predator-prey dynamics in the John Day Reservoir (Poe and Rieman (eds.) 1988; Nigro, ed. 1989). Monitoring of fish responses to northern squawfish harvest is an integral element of the proposed program. Data collected during program evaluation would provide a basis for program management, in response to effects of northern squawfish harvest on the fish communities.

The Endangered Species Act of 1973 as amended 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 recently listed Snake River sockeye as endangered and is currently considering whether to list Snake River fall and spring/summer chinook salmon as endangered or threatened species under the Endangered Species Act.

Responding to the listing and potential listings, BPA proposes to implement northern squawfish management on an accelerated schedule. The accelerated schedule would implement the sport fishery in the Snake River, with indexing to determine the significance of predation at the sport-reward check station locations. The level of involvement in the northern squawfish fisheries would be based on the results from John Day Reservoir to ensure that the harvest target is achieved. There would be no incidental catch of Redfish Lake sockeye due to this project because sockeye do not feed on bait used by fishermen to catch northern squawfish. Therefore, BPA has determined that this program would have no adverse affects, including incidental or direct catch, on a listed species.

The USFWS has indicated that the project would not affect any threatened or endangered species (Hill, personal communication 1991). Although the bald eagle has been identified as a listed species within the Columbia and Snake River area (project area) it has been determined that this project would have no affect on this species. There would be no direct disturbance caused by this project because no construction would be required. The low numbers of northern squawfish proposed for removal (10-20 percent per year) would not affect bald eagle foraging or prey availability.

Numbers of boaters may increase in some areas due to the project. However, based on ongoing research, these numbers are low in relation to other fishing activities. Boaters would use established boat ramps and numbers would be spread over large areas throughout the various reservoirs. Therefore, due to these determinations, BPA has concluded after informal Section 7 consultation that the project would have no adverse affect on any threatened or endangered species.

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 would be no new facilities or other development in a floodplain, so this action is consistent with Executive Order 11988, Floodplain Management, which requires Federal agencies to avoid floodplain development whenever there is a practicable alternative. Because this action would not affect water quality or discharge pollution to the water, water quality standards would not be exceeded, and this action is consistent with the Federal Water Pollution Control Act (33 USC 1251 et seq.) and the Clean Water Act (33 USC 1344) and would 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 recreational 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 would enhance sport fishing by providing a monetary incentive for northern 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 would be expected. A component of the evaluation is monitoring the socioeconomic effects of northern squawfish management activities (Hanna 1989; Hanna and Pampush 1990).

Recreational Concerns. Northern squawfish management would not be expected to interfere with existing recreational activities on the water and at launch sites. A fishing platform may be constructed in a boat-restricted zone at The Dalles Dam. Because the platform would be located in an area restricted to boat access, no potential interference with recreational interests would occur. During the 1990 and 1991 sport reward fishery, few conflicts at boat launch sites such as congestion on ramps or on the water occurred (Hanna and Pampush 1990). Late in the summer, there would be 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 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 recreational fisheries. Ongoing monitoring and evaluation would be conducted to direct management of this program and to minimize conflicts with these and other recreational activities.

The preferred alternative would not affect any National Trails or Wilderness areas or any State designated parks or natural areas. The program activities

would take place within the Columbia Gorge National Scenic Area. Recreation effects would be limited to minor increases in the number of anglers and commercial fishing boats on the reservoirs. These minor increases would not be significant and should not affect 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 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 the 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.

Wildlife and Riparian Vegetation Concerns. The preferred alternative would not affect any vegetation. No listed or proposed endangered or threatened plant species or candidate plant species would be affected, because no new facilities requiring construction are planned.

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 would not affect any wetland or adjacent areas and complies with these regulations listed above.

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 inexpensive 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 on the Snake River, the nation's deepest river gorge. The river systems provide economic support for trade, providing transportation for goods to and from the interior of the Pacific Northwest.

The proposed program would not affect established industries or water used for agriculture, recreation, or power generation. The economic effects related to this project would be insignificant. There would be some increase to local business related to the sport-reward fishery but it would be spread throughout the Columbia Basin and would be from May to September each year.

Regulations pertaining to "food fish" prevent "wanton waste" of northern squawfish and requires utilization of these fish once harvested (Oregon Wildlife and Commercial Fishing Codes 1987-1988). Several end uses for northern squawfish are being studied to ensure that northern squawfish caught are used (Hanna and Pampush 1990). 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 northern 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 restaurants and retail stores. Inland Pacific Fisheries also showed an interest in experimenting with northern squawfish fillets to be minced and frozen for human consumption.

Harvested northern 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 northern squawfish. Researchers concluded that these potential uses make it possible to use all harvested fish (Hanna, Oregon State University, personal communication).

The name "northern squawfish" does not appear to be a hindrance to marketing in the Asian market, but may be a problem if northern 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 (Hanna 1990).

Transportation of northern squawfish to markets was not a problem. The northern squawfish were able to resist the stresses of moving when handled properly. Northern squawfish skin mottles within 1 day after death, which 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 whether the fish was live or iced. Any money received through marketing will go back to the program to recover part of the cost.

Northern 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 are suitable for human consumption. Results of tests for dioxin accumulation are not yet available (Hanna, Oregon State University, personal communication).

A commercial fishery designed to reduce northern 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 $12,600 was awarded in the 1990 sport reward fishery and $500,000 in the 1991 sport reward fishery (Ward, ODF&W, personal communication) through funding provided by BPA. Estimates for an extended fishery are between $500,000 to $750,000 per year awarded to sport anglers participating in this fishery (Maslen, Bonneville Power Administration, personal communication). This action may bring more recreation dollars to local merchants who provide services or supplies to anglers. This would 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 requires 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 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. Northern 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 northern squawfish would be used. Other fish caught incidentally would be released. An increase in solid waste would not be expected. No hazardous waste would 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 would be short term, limited to the fishing season, and insignificant. Because additional activities would be 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 would be used. The northern squawfish lacks religious or cultural significance to Tribes in the Columbia River Basin. Northern squawfish harvest would not be 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 that 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 that 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 would 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 nonagricultural uses. This program would not affect any farmland.

4.2.2 Fish and Wildlife Conservation

The Fish and Wildlife Coordination Act requires that fish and wildlife receive equal consideration with other elements of a proposed action. To minimize potential impacts to fish and wildlife, the proposal was evaluated in consultation with U.S. Fish and Wildlife Service, NMFS, and the States (Oregon, Washington, Idaho). The preferred alternative would benefit salmonids, and may incidentally affect other species. Due to the nature of the project which is to reduce numbers of northern squawfish, northern squawfish would be affected.

Because the proposal was developed as part of Sections 200 and 400 of the Columbia River Basin Fish and Wildlife Program, it is consistent with the Council's Power and Conservation Plan.

4.2.3 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 would not require construction, removal, or rehabilitation of any structures in navigable waters.

4.2.4 Permits for Discharges into Waters of the United States

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

4.2.5 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 would be used or produced.

4.2.6 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 would be used in this program.

4.2.7 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 would be manufactured or used in this program.

4.2.8 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 would be constructed for this program.

4.2.9 Global Warming

This program would 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 - Tom Poe, Diana Hwang, Denny Lassey, Richard Hill, Craig Tuss, Steve Duke
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
Kalispell 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

*/ Current affiliation: Bonneville Power Administration

CHAPTER 6

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