Development Of An International Conservation Strategy For Burbot In Idaho And British Columbia

Vaughn L. Paragamian, Idaho Department of Fish and Game, 2750 Kathleen Ave., Coeur d'Alene, ID 83814
Steve Yundt, Idaho Department of Fish and Game, 600 S. Walnut St., Box 25, Boise, ID 83707
Jay Hammond[1], British Columbia Ministry of Air, Land, and Water Protection 401-333 Victoria St., Nelson, British Columbia V1L 4K3 Canada
Colin Spence, British Columbia Ministry of Air, Land, and Water Protection 401-333 Victoria Street, Nelson, British Columbia, V1L 4K3 Canada
Susan C. Ireland, Kootenai Tribe of Idaho, P.O. Box 1269, Bonners Ferry, ID 83805
Greg Hoffman,[2] Montana Department of Fish Wildlife and Parks, 475 Fish Hatchery Road Libby, MT 59923
Jeff Laufle, US Army Corps of Engineers, P.O. Box C-3755, Seattle, WA, 98124

Abstract

Burbot (*Lota lota*) once provided popular sport, commercial, and subsistence fisheries in the lower Kootenai drainage of Idaho and British Columbia. However, the respective burbot fisheries collapsed in the late 1970s and closure of the fisheries provided no improvement to the burbot populations. Research indicated one of the primary problems affecting burbot is high peaking flows released from Libby Dam during winter spawning migration. Other physical and biotic changes to the ecosystem also may have played a role in the decline of burbot. The burbot in Idaho and Kootenay Lake are currently near demographic extinction. Agencies responsible for burbot management believe efforts should be made to recover this stock, and fisheries and river managers feel development of a conservation strategy could be useful to identify and prioritize actions necessary to recover burbot. The most important aspect of the conservation strategy, designed to be refined or amended as new information becomes available, may be identification of factors limiting the population. This paper provides the logic behind most categories within the burbot conservation strategy and can be used as an example in preparation of strategic documents for other species at risk. If management agencies and water use managers agree in writing to follow the prescribed measures of a conservation strategy then the strategy becomes a conservation agreement.

Key words: burbot, conservation strategy, Kootenai River, Kootenay Lake, *Lota lota*

Introduction

Most native sport fishes of the Kootenai River system are at risk or threatened with extinction, including the Kootenai River white sturgeon (*Acipenser transmontanus*) (59 Federal Register 45989 1994), bull trout (*Salvelinus confluentus*) (63 Federal Register 31647 1998), interior redband rainbow trout (*Oncorhynchus mykiss gairdneri*) (Williams et al. 1989), westslope cutthroat (*O. clarki lewisi*), kokanee (*O. nerka*) (Partridge 1983), and burbot (*Lota lota*) (Partridge 1983, Paragamian et al. 2000). Recovery plans, or conservation strategies, have been prepared for the two listed species in the Kootenai River: white sturgeon and bull trout (State of Idaho 1996, USDI Fish and Wildlife Service 1999). Recently, i.e., 2 Feb 2000, the Idaho Conservation League and American Wildlands petitioned the

[1] Current address: Golder Associates Ltd., 500–4260 Still Creek Drive, Burnaby, British Columbia, V5C 6C, Canada.

[2] Current address: U S Army Corps of Engineers, Libby Dam Project Office, 17115 Highway 37, Libby, MT 59923-9703.

USDI Fish and Wildlife Service (USFWS) to consider an emergency endangered listing for burbot in the Kootenai River, Idaho.

Burbot fisheries in the Kootenai River of Idaho and British Columbia (BC) and Kootenay (Canadian spelling) Lake, BC, once provided important fishing and subsistence opportunities, but are now in a state of collapse (Paragamian et al. 2000). Because of their native status and historical fisheries importance, agencies responsible for management of burbot and their habitat formed the Kootenai River Burbot Recovery Committee to formulate a conservation strategy. The goal of the committee was to develop a cooperative approach to prevent any further decline and identify actions needed to rehabilitate the burbot population.

The committee subsequently developed an international conservation strategy for burbot in the Kootenai River of Idaho and BC and Kootenay Lake, BC, to facilitate conservation activities for burbot. This conservation strategy is also applicable to the Montana reach of the Kootenai River from the Idaho border upstream to Kootenai Falls, Montana; however, information regarding burbot is limited from this reach of river. Thus, this document does not fully consider burbot in the Montana reach. This document, patterned after conservation strategies prepared for Bonneville cutthroat trout (*O. clarki utah*) in Idaho and Utah, and bull trout in Lake Pend Oreille, Idaho, matured through the efforts of representatives from several state, provincial, federal, and tribal agencies. We describe here a series of elements from the original International Conservation Strategy for Burbot in the Kootenai River, Idaho, and British Columbia to provide the reader, through example, a reference or a guide toward developing conservation strategies for other species at risk.

A conservation strategy is one approach to identify actions aimed at reducing threats to a population once it is determined at risk of extinction. If management agencies agree in writing to follow the prescribed measures of a conservation strategy then the strategy can become a conservation agreement—other definitions of a conservation agreement also exist. A conservation agreement is a positive step towards avoiding federal intervention such as listing under the Endangered Species Act (ESA). Under Section 4 of the ESA it may be used in lieu of a recovery plan. Other benefits may include less regulatory imposition and bureaucracy.

In this particular case, a conservation strategy was believed necessary for several reasons: 1) the burbot population in the Idaho and British Columbia portion of the Kootenai River is at risk of demographic extinction and considered genetically different than burbot in the upper river above Kootenai Falls, Montana (Paragamian et al. 1999); 2) Libby Dam, built on the Montana reach of the Kootenai River in 1972, has a complex set of operating protocols, e.g., flood control and hydropower, that did not originally consider biological effects and may have significantly influenced the decline of burbot in the river downstream (Paragamian et al. 2000); 3) federal agencies involved in river management, e.g., U. S. Army Corps of Engineers (USACE) and Bonneville Power Administration (BPA), had no compelling mandate to move forward to rehabilitate the habitat in the Kootenai River to aid burbot conservation; and 4) there is the prospect of a listing action under the ESA and some state, federal, provincial, and tribal managers believed it important to have a conservation strategy in place if and when the opportunity to implement a conservation agreement arose. If the population were listed as endangered, a recovery team would be formed to develop a recovery plan. An existing conservation strategy for burbot would be a useful foundation for a recovery plan and hasten implementation of recovery efforts. Such a plan would give state, tribal, and provincial agencies more responsibility for implementation of conservation measures and a greater role in the federal listing and recovery processes.

The Conservation Strategy Committee

Conservation committees can be organized by and comprised of anyone with a dedicated interest in preparing a cooperative management document to restore or rehabilitate a population at risk of extinction or to reduce a threat to the population's integrity. The senior author organized and chaired the Kootenai River Burbot Committee comprised of state, federal, provincial, and tribal agency biologists and managers with technical expertise to contribute to specific areas of need in the document or represent agencies and organizations with a vested interest in the persistence of burbot. The chairman scheduled and conducted meetings at approximately six-month intervals. First the structure of the conservation strategy was studied, and then assignments were made, which emphasized areas of expertise, to prepare specific segments of the document.

Local support may be one of the most important attributes to success of a conservation strategy. Addition of members of local community government to a conservation strategy committee may benefit the process by providing a historical and socioeconomic perspective as well as political or local public support. Although local governments knew of our efforts to prepare a conservation strategy for burbot we brought them into the process only after it was complete. Our experience later suggested that when local individuals directly impacted by management changes—water management in our case—are included at some stage of the process, preferably at conception, they likely will take direct ownership in it, provide support, and may eventually identify with its success. In addition, concern regarding listing under the ESA, and associated loss of local control of the process (either real or perceived) also provides local governments an incentive for involvement.

Certainly with the myriad of agencies and personalities active on a conservation strategy committee, disagreements regarding document wording, obligations, jurisdictional or management authorities and responsibilities, or the development of appropriate management actions or measures are inevitable. For example, during preparation of the Kootenai River Burbot Conservation Strategy, two federal agencies were hesitant to fully engage until assured that the conservation strategy had no legally binding authority. It is the responsibility of the chairman to guide resolution of disagreements and clarify misunderstandings. Generally, producing a legally binding conservation agreement based on the conservation strategy is more difficult because managment agencies must disclose their true position and make financial, logistical, or operational concessions to facilitate recovery/rehabilitation efforts.

The Conservation Strategy

Life History

This section lays out a framework of the basic life history characteristics of the species of concern. Important components include critical habitat needs of each life history stage and where the candidate species fits into the trophic structure of the fish community. Of particular importance are factors that make the species unique or vulnerable to habitat alterations or other human-caused influences. In the case of burbot in the Kootenai River, important life history characteristics include extensive winter spawning migrations, highly synchronized migration and annual maturation, low swimming endurance, and potential impacts of changes in water temperature. The objective is to clearly tie these life history characteristics and any changes in population status, based on scientific evidence, to environmental disturbance or natural change that directly impacts the population.

Burbot are the only freshwater member of the family Gadidae, the cod family, reaching a weight of about 4.5 kg in Idaho and BC. Burbot are winter spawners,

spawning at temperatures usually below 4 °C (McPhail and Paragamian 2000) and are highly synchronized in both gonadal development on an annual basis and arrival to a spawning site (Arndt and Hutchinson 2000, Evenson 2000). Burbot spawn in large groups called "spawning balls" and a female burbot may release over one million eggs (Becker 1983). The eggs are semi-buoyant and drift downstream to a lake to hatch and rear. Very young burbot are pelagic and feed on zooplankton. As they grow in length (≥15 mm) they move to the shoreline and feed on insects and small fish. After the first year of life they move into deeper water, feeding on fish and Mysid shrimp (*Mysis relecta*). Male burbot mature at about age-3 and age-4 while females mature at about age-4 and age-5. Burbot have low stamina and swimming endurance (Jones et al. 1974). Velocities >25 cm/s affected sustained swimming endurance when subjected for >10 minutes (Jones et al. 1974). Thus, it is reasonable to believe increased flow at critical periods could affect spawning success.

Status and Distribution

This section should provide a historic background of the abundance, distribution, and recreational importance of the species, as well as information of cultural and social importance. Temporal changes, especially declines in regards to any of these aspects, are important to frame the conservation need. In the case of burbot in the West Arm of Kootenay Lake, a creel survey over 20 years provided chronological evidence of the decline in the burbot fishery. Fishery surveys also can provide valuable information on the timing of significant population change. A discussion of distribution of the species of interest may support categorization of a population as of special concern or rare status. Distributional information also helps define geographic, management, and jurisdictional boundaries. Anecdotal information can be used with caution to describe population trends.

Idaho.—Although burbot are circumpolar in distribution, including the northern tier of states, Alaska, and most of Canada (McPhail and Paragamian 2000), they are endemic only to the Kootenai River in Idaho (Fig. 1; Simpson and Wallace 1982). The earliest records of burbot sampling in the Kootenai River, Idaho were taken from the Idaho Department of Fish and Game (IDFG) Panhandle Region archives during the 1957-1958 winter. The combined sport and commercial fisheries in Idaho during the 1950s and 1960s are thought to have yielded >2000 kg/year. Soon after completion of Libby Dam, in 1972, a substantial reduction in the abundance of burbot was noted. After dam closure, Partridge (1983) captured a total of 108 burbot from 1979 through 1982; however, a follow-up study of burbot captured only 17 burbot in 1993 (catch/unit effort [CPUE] of one burbot/33 net days) and eight in 1994 (CPUE of one burbot/111 net days). Numerous age groups of fish were represented in the net catch, indicating some burbot recruitment. Recruitment was apparently coming from the Goat River in BC, the only known spawning location (Paragamian 1995; Fig. 1). We found no evidence of reproduction in Idaho.

The historical burbot fishery in Idaho was primarily a winter fishery although some fishing occurred in spring. Following construction of Libby Dam, warmer winter water releases from Lake Koocanusa, formed by the dam, eliminated ice cover and the associated ice fishing on the Kootenai River (Partridge 1983). Burbot regulations in Idaho were liberal, i.e., no closed season or bag limit, until 1984 when the state adopted a two-fish/day limit. A ban on all burbot harvest followed in 1992.

Kootenay River and Lake, British Columbia.— The burbot population in Kootenay Lake and the Kootenay River in BC are red-listed—identified as threatened or at risk of extinction—as an imperiled population in BC. Historically, the primary fishery for burbot was in the West Arm of Kootenay Lake near Balfour, BC, and was primarily a late spring-early summer fishery.

In the West Arm of Kootenay Lake

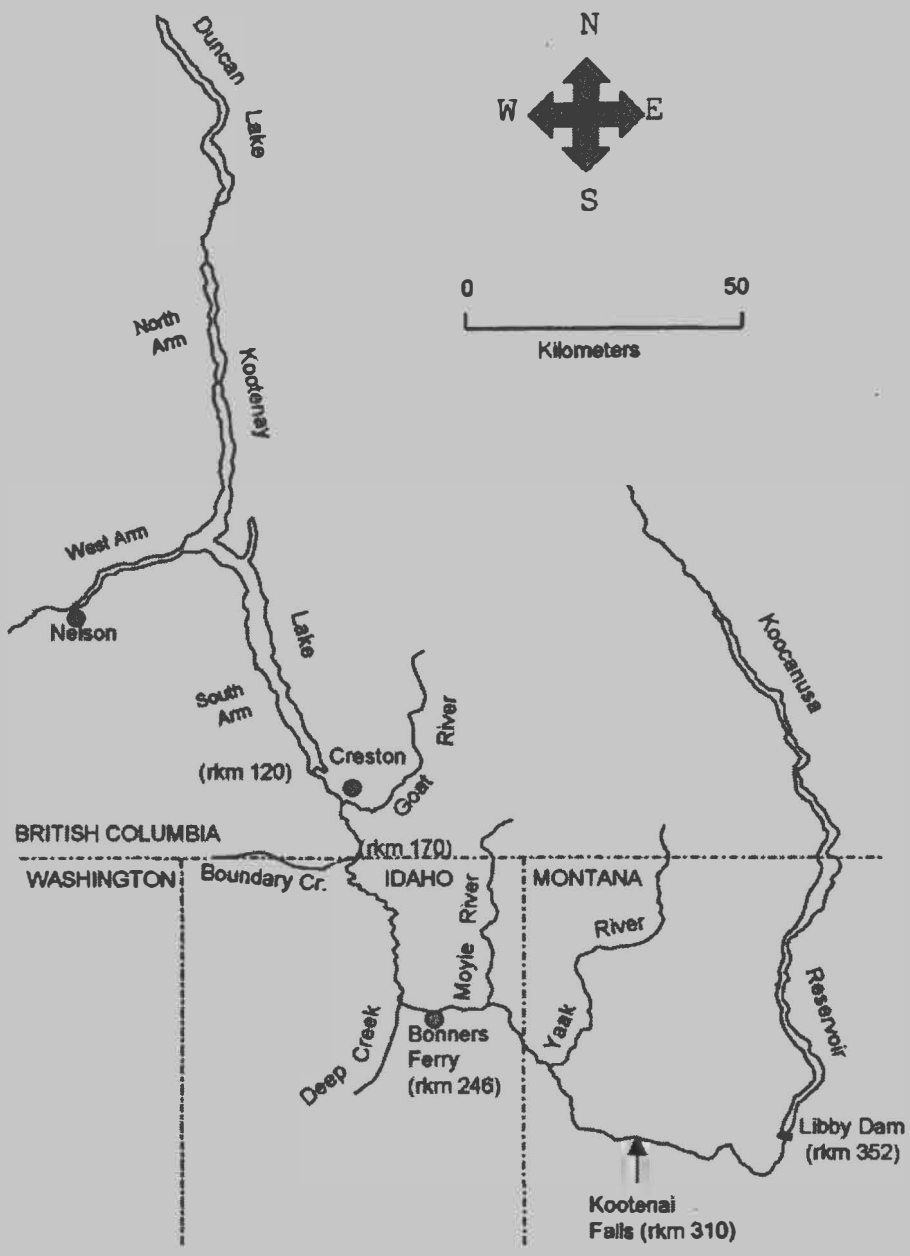

Figure 1. Kootenai River and locations of Bonners Ferry, Libby Dam, Lake Koocanusa, Kootenay Lake, and other important locations , including river kolometer (rkm).

over 26,000 burbot were caught in 1969 and about 20,000 in 1971. The angling catch rate of burbot averaged about one fish/hour during the 1969-1971 period. Until the mid-1960s, the daily harvest limit was 15 burbot/day but was lowered to 12/day in 1967 (Sinclair and Crowley 1969). Harvest of burbot declined substantially in years following 1971, and angling overharvest was a concern. As a result, the daily limit was reduced to 10 burbot/day in 1975 (Andrusak 1976) and to 5 fish/day in 1976 although no corresponding improvement in the burbot population was observed. Harvest of burbot continued to decline through the 1970s with angling catch success remaining at about 0.7 fish/hour. As of 1987, no fish were recorded in the West Arm fishery and in 1997 the lake was closed to burbot fishing. We know little of the historical fishery in the Kootenay River, BC.

Kootenai Tribe and burbot fishing.— The Kootenai Tribe historically relied

heavily upon burbot to provide a dietary staple and they were very adept at using weirs and traps to capture burbot. The following information was provided by the late Abe Abraham, a well respected Kootenai Tribal Elder: *" The ling moved into the tributaries to the Kootenai River from Kootenay Lake all the way to the mouth of the Moyie River. We fished for ling through the ice in February using lines and large hooks baited with squawfish and peamouth chub. Ling were extremely abundant and were a main staple for the Tribe in the late winter/early spring months. They were the most important food source for the Tribe at that time of year."* Additionally, the Tribe recognizes the connection of all resources in the web of life, and that the preservation of all native fish is important to the ecosystem.

Principle Habitat Concern

An important segment of the conservation strategy is to explain what is known of the major threats to the population, which can and often does include habitat changes. For burbot in the Kootenai River, it is important to understand the operational procedures for Libby Dam because hydro operations are thought to have significantly affected habitat in the river and contributed to decline in the burbot population. Understanding how the habitat has changed or, in this example, the agent of change—Libby Dam—can provide insight into the effect on the ecosystem and native species, as well as how effects may be modified or mitigated to lessen their impact. For example, an alternative management plan for the operation of Libby Dam called VarQ (U.S. Army Corps of Engineers 1999) attempts to include flood control operational guidelines that are believed, when compared to past guidelines, more considerate of sturgeon and salmon needs, and possibly burbot as well. A conservation strategy for one species, i.e., burbot, should adopt habitat and flow recommendations that are compatible with any exisitng recovery plan of conservation strategies for other species. An additional consideration when considering habitat or operational modifications in a conservation strategy is compatibility with other Recovery Plans or Strategies of other species at risk, e.g., white sturgeon, that are already in place. Ideally, conservation strategies should complement each other.

Libby Dam on the Kootenai River in Montana is authorized primarily for flood control and power production, and is operated by the USACE. Operating guidelines for endangered fish populations are specified in the 1995 and 2000 Biological Opinion for Kootenai River white sturgeon (Dwyer 1995, USDI Fish and Wildlife Service 2000), the 1995 Biological Opinion for Snake River salmon (National Marine Fisheries Service 1995), the 1998 Biological Opinion for Columbia/Snake River steelhead (National Marine Fisheries Service 1998), a 2000 Biological Opinion for the listed bull trout (USDI Fish and Wildlife Service 2000), and annual guidelines from the USFWS (National Marine Fisheries Service 1998). From April until July each year, USACE strives to fulfill the sometimes-conflicting objectives of flood control and flow augmentation for endangered Kootenai River white sturgeon and endangered salmon populations downstream. A federal project such as Libby Dam is often forced to confront the sociopolitical conflicts of species recovery vs. human needs or expectations, and agency mandates. For example, increased flows for sturgeon or salmon are thought by some to be a threat to agricultural grounds and the local economy. At Libby Dam, the flood control and power operation takes precedence over sturgeon recovery and salmon needs, which is based on providing 200-year flood protection.

More recently negative consequences for burbot have become apparent (Paragamian 2000) during the critical winter spawning months due to the operation of Libby Dam. During winter the dam is operated to draw down Lake Koocanusa in preparation for spring runoff, as well as to maximize winter power revenue; thus, winter river velocities are

substantially higher than pre-dam conditions at a time when burbot are migrating and spawning in the Kootenai River. As previously noted, burbot are ill equipped to withstand the higher velocities resulting from dam operation.

Problems Significantly and Negatively Affecting Candidate Species

Another important aspect of a conservation strategy is identifying factors most limiting to a population or species of concern. Development of this section should include an exhaustive literature review and discussion of research results that identify limiting factors directly linked as a threat to the species or a specific portion of its range, e.g., population. The narrative then synthesizes and explains how the factors may have impacted the species or population of concern, including shortcomings or gaps in available information. Including published peer-reviewed studies adds credibility to the strategy. Presenting categories in an orderly manner also provides a measure of logic. This section can be refined or amended as new information becomes available, but should rely on the best available information at the time of preparation of the final conservation strategy. Understanding the limitations is critical for developing recovery strategies and their expected outcomes.

Dam operation and reservoir management.— Operation of Libby Dam for hydropower, which included power peaking until 2000 when it was discontinued, and flood control changed the river's natural hydrograph from low flows in winter and high flows in summer to post-dam flows that are comparatively lower in summer and higher in winter. The release of water impounded in Lake Koocanusa also has elevated winter water temperatures and reduced summer temperatures (Partridge 1983, Paragamian et al. 2000).

Prior to construction of Libby Dam winter, the time when burbot migrate and spawn, was the most environmentally stable period of the year. Burbot travel over 125 km to spawn (Bresser et al. 1988). Burbot in the Kootenai River are thought to have traveled ≤120 km from Kootenay Lake to spawn in tributaries in Idaho (Paragamian 1995). Elevated winter flows and water velocities from Libby Dam have disrupted burbot spawning migration, in terms of the timing of activity and upstream passage (Paragamian 2000). The specific effect of this disruption to burbot spawning is unknown, but it may have diminished spawning fitness, changed spawn timing, reduced stamina, or even impacted reproductive fitness. Any one of these impacts could collapse the fishery by reducing spawning success and recruitment (Paragamian 2000, Paragamian et al. 2000). Fluctuating flows from Libby Dam appear to provide confusing migration cues and disrupt upstream spawning migrations by burbot (Paragamian 2000). Many burbot with sonic transmitters demonstrated interrupted sequences of upstream movement, no movement, and/or fall back during the winter of 1994-1995 and 1997-1998 that was presumably related to documented flow changes. Daily differences in flow from Libby Dam during the winter can range up to about 650 m^3/s.

Nutrient losses.— As with many reservoirs, Lake Koocanusa acts as a nutrient sink and has reduced productivity of the river downstream (Snyder and Minshall 1996, Woods 1982) and Kootenay Lake (Northcote 1973). Unpublished data indicates the loss of primary productivity due to nutrient loss in the river might have played a role in the collapse of burbot (Paragamian 1994, Ahems and Korman 2002), possibly by limiting resources available to young burbot.

River temperature.— How warmer winter temperatures in the Kootenai River may affect burbot spawning migration and spawning is unknown. During the winters of 1994-1995 Paragamian (2000), using sonic tags, found burbot were attracted to the colder water of the Goat River from the Kootenai River when temperatures were 0 °C and 4 °C, respectively. Soon after this

observation burbot ascended the Goat River to spawn. However, several days later when the temperature of the two rivers was similar, three additional burbot in the Kootenai River bypassed the Goat River on a suspected spawning journey into Idaho. We have no evidence to suggest these burbot spawned. How warmer temperatures affect burbot reproductive success since they are temperature sensitive (Becker 1983) requires further research.

Conservation Goal

The conservation goal section of the conservation strategy provides a broad overview of contingencies that must be accomplished for the successful recovery/ rehabilitation of a candidate population and recognition of when the goal is accomplished. The conservation goal may provide a brief statement of why the goal is achievable, provided the recommended measures are implemented. It also reaffirms a commitment to what level of recovery/ rehabilitation will be achieved, e.g., a self sustaining population.

The goal of the burbot conservation strategy is to maintain and restore multiple life history strategies, and maintain the genetic diversity necessary to sustain a viable burbot population. Restoration of the burbot population will be considered complete or successful when monitoring and evaluation of the population indicates a healthy age-class structure and a sufficient fish density to support harvest for subsistence and sport fishing. Sustained burbot populations have environmentally stable spawning and rearing habitats, juvenile habitat, and adult habitat (McPhail and Paragamian 2000). Restoration or rehabilitation of the burbot population in the Kootenai system is contingent on significant habitat changes; for example, lower winter flows during burbot spawning migration and spawning, improved food productivity, and perhaps lower winter water temperatures.

Conservation Objectives

Conservation objectives should be established from an analysis of the factors limiting the viability of the species. An objective includes the tasks or measures necessary to reduce or eliminate one or more limiting factors. Simply put, *"What is necessary to recover/rehabilitate the candidate species?"*

For burbot recovery efforts to be successful, i.e., goal attained, the physical and biological environment required by all the species' life stages must be restored or rehabilitated and maintained. The objectives necessary to do this must be achievable, repeatable, and measurable, e.g., evidence of reproduction, increasing population numbers, or movement to spawning tributaries during winter. The burbot population must respond to the actions and measures of an objective. These objectives can be reorganized, changed, or become more specific when framing a conservation agreement. This section must provide the specific measures that are necessary to recover or rehabilitate the target species or population based on the information available when the conservation strategy is finalized. As such, the following include objectives for the burbot conservation strategy:

Ecosystem recovery.—To recover the burbot population, a more normal riverine ecosystem with less influence from Libby Dam must be restored and the loss of primary productivity must be addressed. An approach such as the adaptive ecosystem assessment (AEA) methodology, which has shown usefulness in previous studies (Walters et al. 1996, Ashley et al. 1996), could be used to model ecosystem response to manipulation of environmental variables known to be important to burbot. Such methodology could provide some insight regarding the response of the burbot population to large-scale ecosystem rehabilitation actions, such as addition of nutrients to the system to improve productivity, before costly and controversial actions are actually deployed.

Flow manipulation.—Current flood rule curves used by the USACE should be modified and winter (Jan and Feb) flow

levels in the Kootenai River should be returned to pre-dam levels (~170 m^3/s), in order to facilitate the burbot spawning migration. This would provide burbot a migration corridor more similar to natural conditions and allow uninterrupted migration to tributaries in Idaho. Reduced winter flows would also equate to cooler more natural temperatures. Because the population is transboundary, these recommended changes are expected to benefit burbot in the Kootenay River and Kootenay Lake in British Columbia. VarQ, a proposed USACE hydrosystem flood control operation for the Columbia River Basin (U.S. Army Corps of Engineers 1999) should be adopted and, in combination with Kootenai Integrated Rule Curve (KIRC) (USDI Fish and Wildlife Service 1999), could result in a configuration of flows beneficial to burbot recovery (USDI Fish and Wildlife Service 1999) below Libby Dam.

Donor stocks.— Because burbot stocks in the Kootenai River have been depleted to the point of near demographic extinction, the life history attributes and population genetics of other burbot stocks in the drainage, e.g., Duncan and Moyie lakes, should be documented as potential refounders. If the Kootenai stock reaches a point where recovery is unlikely even with habitat and flow management, and extinction risk is high, the introduction of burbot of similar genetic makeup and life history may be necessary to enhance or refound burbot in the system to aid in recovery.

Confined brood stocks.— Experimental enclosures containing gravid burbot should be used to determine their affect on enhancing natural reproduction. Burbot reproduce in large schools and spawners may have a strong affinity to other spawners. Restoration of burbot may be enhanced by maintaining gravid burbot in an enclosure, to act as attractants to other potential spawners.

Burbot culture.— Culture of burbot is a new endeavor and should be considered experimental at this time. If culture is determined to be feasible for burbot, this tool should be used to prevent extinction and preserve the remaining gene pool while other measures are implemented to restore habitat conditions necessary for successful recruitment of stocked individuals.

Additional turbines at Libby Dam.— The installation of additional turbines at Libby Dam should be considered. Additional turbines would allow for more flexibility in water management, such as spring flood control, because higher flows could be passed without spilling (and associated dissolved gas problems) when the reservoir is full. Thus, an additional turbine that allowed greater flood control capabilities would reduce the concern for higher spring reservoir elevations, allowing a reduction in winter flow.

Spring management of Kootenay Lake.— The management of Kootenay Lake should be studied for potential impacts on burbot. This poorly understood aspect of the Kootenay River system could have an effect on burbot. Since construction of Libby Dam, a dam downstream of the outlet artificially controls the elevation of Kootenay Lake. The International Joint Commission Board of Control, a joint commission of the U.S. and Canadian governments, governs water elevation in Kootenay Lake. The possible impact of lowering Kootenay Lake each spring potentially threatens rearing of larval burbot in tributaries. Elimination of the spring draw-down of Kootenay Lake, drafting the lake at a much slower rate, and setting the target elevation date for Kootenay Lake back by at least one month could benefit burbot and should be examined.

Assessment techniques.— The stock status of the burbot population must be determined annually to evaluate changes due to implementation of recovery objectives. There is also a need to continue improving adult and juvenile stock assessment methods to better monitor recovery efforts and progress. However, as the burbot population decreases in number, it becomes increasingly difficult to monitor the population. In addition, any

unnecessary handling may pose a threat to the survival of individual fish.

Monitoring, Compliance, and Review of Conservation Measures

This final section of the conservation strategy lays out the general responsibilities for the participating and managing agencies and is based on the assumption that a conservation agreement will be adopted, coordination will be necessary, and actions will be implemented. It should include an implementation schedule that provides a calendar of actions such as remedial measures, monitoring, and evaluation needed to fulfill the defined objectives. Monitoring and evaluation include following trends in the target population, both before and after restoration actions are initiated, and providing progress reports to the Conservation Committee regarding implementation of the overall plan and its success in recovery or rehabilitation of the species or population. Annual reports are needed to document activities, add to the developing database, and provide insight or guidance to changes that may be necessary to the conservation agreement. Most importantly, this section must explicitly define individuals or agencies that are responsible to complete, i.e., fund, identified tasks in a timely fashion, either independently or as the lead on a cooperative effort among agencies.

Conclusion

Concurrent with preparation of this manuscript, a local resource advisory council comprised of representatives from local government and other stakeholders in Boundary County, Idaho, federal, state, and Tribal agencies formed to provide a forum for natural resource issues. The Kootenai Valley Resource Initiative has been meeting since January of 2002. A subcommittee of this group was formed in April of 2002 and the first item on their agenda was the crafting of a Burbot Conservation Agreement with the USDI Fish and Wildlife Service, USACE, and BPA. The conservation agreement is based on the adoption of the International Kootenai River Burbot Conservation Strategy. A water management model (based on VarQ) was developed to demonstrate how storage and flow could be manipulated to ensure maintenance of flood control measures for the Kootenai River, but also provide water for white sturgeon spawning and rearing, salmon flows, and suitable winter low flows for burbot migration, spawning, and rearing. The proposed water management scheme would take effect during years of low and normal runoff thereby allowing other operational strategies in high flow years to alleviate flood concern. Studies also are underway to restore nutrients to the Kootenai River and improve food production.

Development of a conservation strategy can be the first step in bringing about a positive working environment and foster the establishment of a conservation agreement. Our example of a conservation strategy provided the reader with a basic plan. Each conservation strategy can differ and there is opportunity to craft each strategy in accordance with the special needs of the species at risk.

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