Figure 1. Columbia River white sturgeon captured, tagged, and released to estimate population status.

1.0 INTRODUCTION

1.1 Background

White sturgeon are a unique and precious component of the biodiversity and cultural heritage of the upper Columbia River but are currently threatened with extinction or extirpation from this area unless rigorous restoration measures are implemented. This species is an integral component of the native riverine ecosystem and historically supported productive traditional and recreational fisheries.

Sturgeon are at risk almost everywhere they occur in temperate river systems of North America, Europe, and Asia, and white sturgeon in the upper Columbia River are no exception. Habitat fragmentation, habitat degradation, and historic fisheries have combined to drastically reduce the range and numbers of this ancient species that has survived the last 175 million years. The upper Columbia River white sturgeon population now consists of several known or suspected subpopulations that have been isolated from each other and from historical critical habitats. Collectively, these populations are considered distinct from other populations in the basin and in other western river systems. Natural recruitment has failed for all upper Columbia River subpopulations which now consist solely of aging cohorts of mature fish that are gradually declining as fish die and are not replaced. Only the longevity of this species and complete fishery closures have forestalled extinction that will be inevitable without effective intervention.

White sturgeon are the largest, longest-lived freshwater or anadromous fish in North American (Scott and Crossman 1973) and are highly adapted to the large river systems in which they evolved. The largest white sturgeon on record, weighing approximately 682 kg (1,500 lbs.), was taken from the Snake River near Weiser, Idaho in 1898 (Simpson and Wallace 1982). Ages as great as 104 years have been reported (Rien and Beamesderfer 1994.) Large size and

opportunistic behavior allowed them to range widely to take advantage of widely-scattered and seasonally-available resources in these dynamic river mainstem habitats and in the ocean. Longevity and high fecundity allowed them to outlast variable environmental conditions and to capitalize on favorable spawning conditions when they occurred.

Population attributes that have proven adaptive for millions of years are now a liability (Beamesderfer and Farr 1997). Large size and high fecundity makes sturgeon a valuable fishery commodity but longevity and delayed maturation make them extremely vulnerable to overfishing. Long life span and benthic feeding also makes sturgeon susceptible to bioaccumulation of industrial and community pollutants with potentially detrimental effects on health, growth, maturation, and recruitment. Critical habitats have been altered. Dam construction has blocked movements and restricted sturgeon to river fragments that may no longer provide the full spectrum of habitats necessary to complete the life cycle. Flow regulation has limited seasonal and annual fluctuations that provide behavior cues and suitable spawning or rearing conditions. All of these changes favor a much different aquatic community of prey, predators, and competitors.

White sturgeon were designated as vulnerable in 1990 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Columbia River population in British Columbia was assigned to the provincial Red List in 1993 based on a B. C. Conservation Data Centre (CDC) status review that described the species as "critically imperilled." The Kootenay River (spelled Kootenai in the U.S.) population of white sturgeon was listed in 1994 as endangered under the U.S. Endangered Species Act (ESA). Upper Columbia River white sturgeon are not currently listed under the U.S. ESA but might qualify for listing if considered. A Species at Risk Act (SARA) is currently in the final stages of legislation by Canada and might similarly apply to upper Columbia River white sturgeon if adopted.

This recovery plan describes strategies and measures to arrest the decline of white sturgeon in the Upper Columbia River Basin, prevent extinction, remove threats to long-term survival, and restore opportunities for beneficial use if feasible. Implementation of this plan represents a proactive approach to species recovery. The structure of this plan is designed to be compatible with Canadian Species at Risk Act (SARA) legislation and the U.S. Endangered Species Act (ESA), such that the plan could be considered the official recovery strategy should upper Columbia white sturgeon be listed in either country.

This plan includes white sturgeon in Canadian and U.S. portions of the Columbia River above Grand Coulee Dam. The subject area is the Columbia River mainstem and its tributaries from Columbia Lake to Lake Roosevelt, the lower Kootenay River from Lower Bonnington Dam to the Columbia River confluence, the Slocan system, and the lower Pend d'Oreille River (spelled Pend Oreille in the U.S.) from Boundary Dam to the Columbia River confluence. A separate recovery plan has been prepared for white sturgeon in Kootenay Lake and River by the U.S. Fish and Wildlife Service (USFWS 1999). The selection of Lower Bonnington Dam as the separation point between the Kootenay and Columbia rivers ecosystems reflects the location of Bonnington Falls which was an impassable barrier to upstream fish passage into the remainder of the Kootenay River system. Activities outside this recovery area are also considered if they impact upper Columbia River sturgeon.

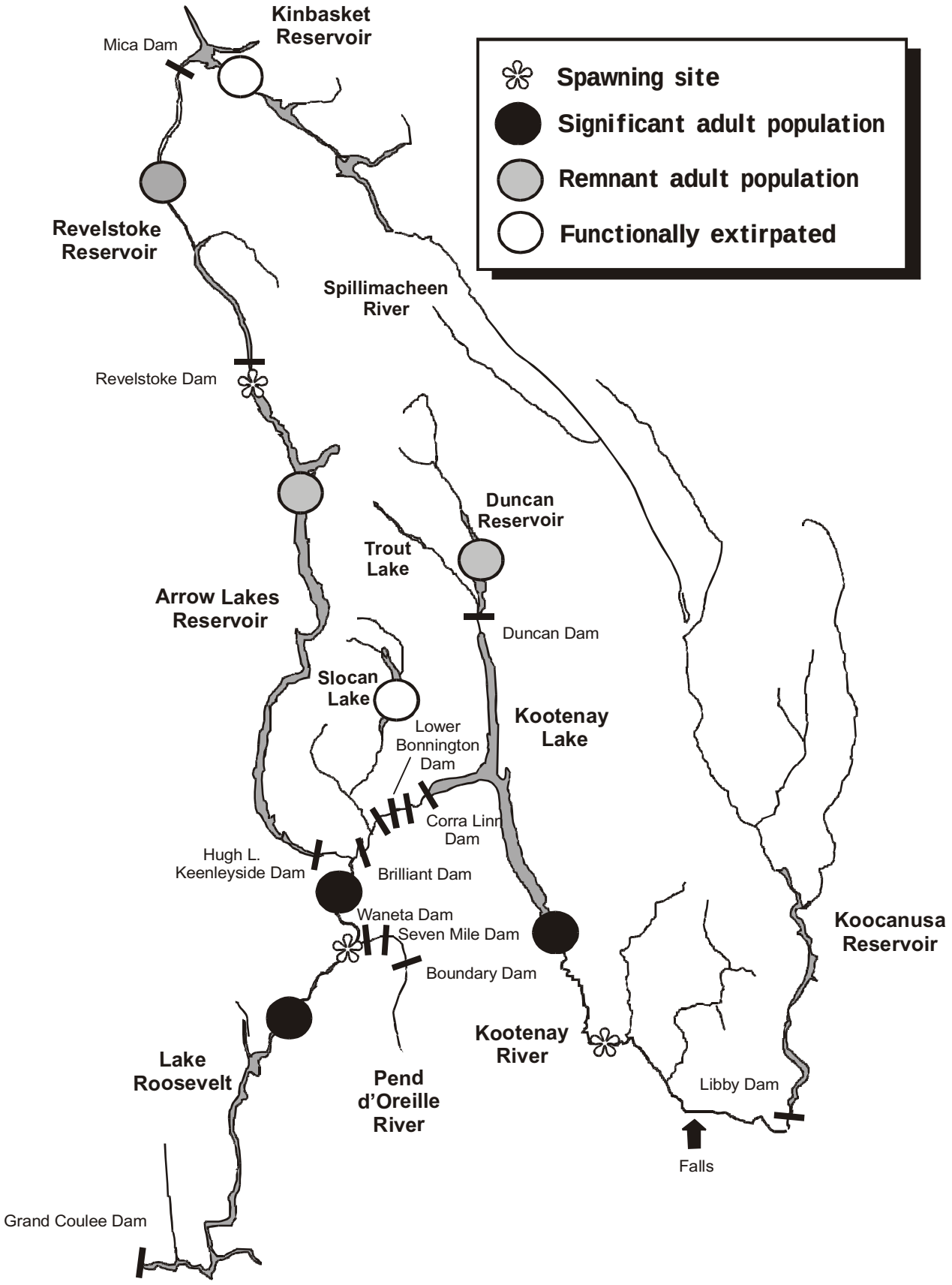

Figure 2. Distribution of white sturgeon in the upper Columbia River basin.

Although white sturgeon are the main subject of this plan, actions proposed for their stabilization could also benefit other native aquatic species and further contribute to overall health of the upper Columbia River ecosystem.

1.2 Outlook Without Intervention

The current population estimate of approximately 1,400 adult white sturgeon in the transboundary reach of the upper Columbia River is substantially less than the endangered status criteria of 2,500 identified by the World Conservation Union (IUCN 1994) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 1998). With the almost complete failure of natural recruitment, current data indicates that the population will decline by an additional 50% within 10 years and 75% within 20 years (Figure 3).

The upper Columbia white sturgeon population will decline below critical thresholds from which recovery may be difficult without immediate, aggressive, and effective intervention. Adult numbers of 500 and 50 have been identified as population benchmarks associated with irreversible consequences in U. S. Endangered Species assessments (Thompson 1991, McElhany et al. 2000, Rieman and Allendorf 2001). Numbers less than 500 result in bottlenecks that rapidly reduce genetic diversity. Numbers less than 50 result in severe genetic impacts related to inbreeding. The population of white sturgeon in the upper Columbia River is projected to decline to less than 500 adults within 14 years and will become functionally extinct around the year 2044 as numbers fall below 50 fish.

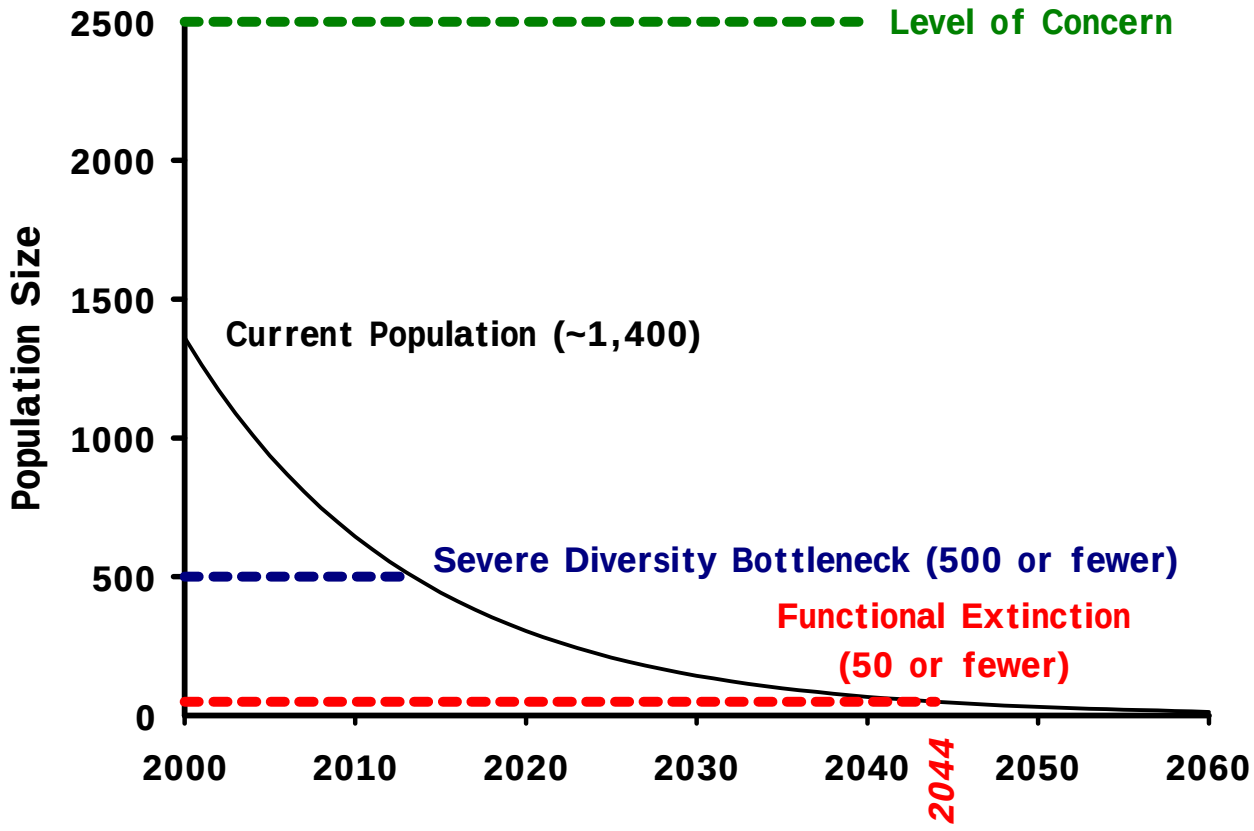

Figure 3. Projected population trajectory without intervention based on current population size and mortality rate.

The long life span of sturgeon requires a long-term perspective but the critical status of the upper Columbia population demands immediate action. The ongoing decline began with recruitment failure at least two decades ago but was not immediately recognized. Opportunities to arrest this decline will be lost well before extinction occurs. Too few fish will remain to take advantage of suitable natural recruitment conditions if they occur and it will become increasingly difficult to capture ripe spawners needed to sustain a hatchery program. Significant uncertainty about the nature of the natural recruitment problems will delay identification of potential solutions. High costs and difficulty of some potential solutions will require consideration of alternatives and risk further delays in implementation. The current critical status of upper Columbia River sturgeon belies a notion that their longevity provides an extended opportunity for implementation of this recovery plan. In fact sturgeon longevity ensures that near term actions or inaction will have long term consequences.

1.3 The Upper Columbia White Sturgeon Recovery Program

The wide distribution and trans-boundary movements of upper Columbia River white sturgeon require effective inter-jurisdictional coordination of recovery efforts. This recovery plan is the product of a cooperative effort by Canadian and U.S. governmental aboriginal, industrial and environmental organizations, stewardship groups, and citizens. A recovery team included technical representatives from Federal, Provincial, and State resource management agencies and from Canadian and U.S. tribes. Plan development also involved an Action Planning Group with representation by the Province, Fisheries and Oceans Canada, regional governments, First Nations, members of the public, environmental and industrial stakeholders, U. S. regulatory and tribal agencies.

The planning process was initiated by Canadian organizations and built upon a Canadian Columbia River white sturgeon stock stabilization document (Hildebrand and Birch 1996). A common commitment to a recovery program was formalized by Fisheries and Oceans Canada, B.C. Environment, B. C. Fisheries, and B. C. Hydro (BCH) with an August 17, 2000 Letter of Understanding. The letter outlined the approach to be taken for recovery planning and described agreements on how available funding was to be used for development and delivery of a recovery strategy. The agreement also defined a process for engaging First Nations and stakeholders (interested parties) in recovery planning in order to build understanding and support for the plan and to explore possible sources of funding for full implementation of the plan. This process led to active U.S. participation by the Spokane Tribe, Colville Tribes, U.S. Fish and Wildlife Service, Bonneville Power Administration, and the State of Washington.

The formal recovery planning process for the Upper Columbia white sturgeon stock was initiated with a September 16, 2000 workshop in Castlegar, B.C. which introduced the proposal for a recovery plan and committee development. Information was presented on the roles and responsibilities of the involved parties; species-at-risk legislation and issues in British Columbia; population dynamics and stock status of Upper Columbia River white sturgeon; human effects and causes for decline; stabilization options for consideration; and other white sturgeon recovery initiatives in North America.

The Action Planning Group and the Recovery Team were organized in late 2000, as an outcome of the September 16 workshop. These groups interacted but were not be hierarchically organized and their respective roles and responsibilities were described in a working draft “terms of reference.”

The Action Planning Group (APG) constituted the 'main table.' Their primary tasks were to develop a common vision for sturgeon recovery and to act as a public liaison with the broader community of affected and interested parties. Specific responsibilities included:

1. achieving consensus on the goals and objectives for white sturgeon recovery;
2. providing input to the Recovery Team on local and traditional knowledge of Upper Columbia white sturgeon;
3. providing advice to the Recovery Team on the potential social and economic impacts of proposed recovery strategies;
4. communicating issues and findings back to their respective constituencies;
5. supporting and promoting recovery plan implementation;
6. encouraging all parties involved in the decline of white sturgeon populations to support implementation of a recovery plan;
7. addressing how to best implement the actions identified by the Recovery Team;
8. and, striving to develop a "contract" in regards to contributions for the development and implementation of the Recovery Plan so that all partners were aware of their obligations.

The Recovery Team was comprised of individuals with technical expertise in relevant areas (sturgeon biology and fish culture, recovery of endangered species, genetics, hydraulic operation of Upper Columbia hydro facilities, and habitat remediation). The overall role of the Recovery Team was to develop and oversee implementation of the Recovery Plan. The plan is a technical document produced through discussion and consensus. Public input into the plan was achieved through on-going communication with and feedback from the APG. Specific responsibilities of the Recovery Team included:

1. assembling accurate baseline data and reviewing reasons for population declines;
2. defining the recovery goal and short, medium and long-term objectives for white surgeon recovery;
3. establishing criteria to evaluate the recovery plan and to define success;
4. designing technical strategies, measures, and supporting research programs to achieve recovery goals and objectives;
5. and, establishing priorities for recovery implementation based on technical criteria and input from the Action Planning Group.

The Recovery Team designated sub-committees for habitat restoration, water management, contaminants, fish culture, and genetics. The water management subcommittee provided information to the Recovery Team regarding potential measures affecting river flows (and/or stages), reservoir elevations, and water quality measures. The habitat restoration subcommittee provided information on habitat losses that could have impacted life stage survival, opportunities for habitat restoration, and long-term habitat management, and restoration measures. The contaminants subcommittee provided information regarding potential impacts of contaminants on sturgeon and alternatives for further exploration. The fish culture subcommittee provided information related to the options, capabilities, and costs of the conservation fish culture program consistent with the recovery team outline for production requirements. The genetics subcommittee provided information regarding genetic risk assessment/management, genetic data needs, and other potential genetics issues, and developed a breeding plan which outlines appropriate hatchery practices.

1.4 Northwest Power Planning Council Fish and Wildlife Program

At the same time sturgeon recovery planning efforts were being developed in Canada, U.S. sturgeon recovery efforts in the upper Columbia River were being organized under the Northwest Power Planning Council Fish and Wildlife Program. The Upper Columbia River Recovery Program provided the opportunity to develop a comprehensive plan for both sides of the border.

This recovery plan is intended to guide sturgeon recovery efforts in the U.S. portion of the river upstream from Grand Coulee Dam consistent with implementation of the Columbia Basin Fish and Wildlife Program under the 1980 Northwest Power Act. This recovery plan is not intended to replace the formal planning process for the U.S. Columbia River Basin Fish and Wildlife Program but should provide a technical basis for sturgeon recovery strategies and measures addressed in that program. This recovery plan may also serve as a master plan for any hatchery-based recovery measures identified for the U.S. portion of the upper Columbia River.

The Pacific Northwest Electric Power Planning and Conservation Act was passed by the U.S. Congress in 1980 and authorized the states of Idaho, Montana, Oregon, and Washington to create the Northwest Power Planning Council (NPPC 2000). The Act directs the Council to prepare a program to protect, mitigate, and enhance fish and wildlife of the Columbia River Basin that have been affected by the construction and operation of hydroelectric dams while also assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply. The Act also directs the Council to inform the public about fish, wildlife, and energy issues and to involve the public in its decision-making.

Through its Fish and Wildlife Program, the Council provides guidance and recommendations on hundreds of millions of dollars per year of Bonneville Power Administration revenues to mitigate the impact of hydropower on fish and wildlife. A series of fish and wildlife programs have been adopted, revised, or amended between 1982 and 2000. In the current Fish and Wildlife Program, specific measures are to be detailed in more than 50 subbasin plans developed locally and amended into the program by the Council. White sturgeon are included in the mainstem subbasin plan.

White sturgeon planning, research, and restoration measures or goals have been included in all recent fish and wildlife programs. The 2000 Fish and Wildlife Program includes white sturgeon in its resident fish section which identifies the following objectives:

1. Complete assessments of resident fish losses throughout the basin resulting from the hydrosystem, expressed in terms of the various critical population characteristics of key resident fish species.
2. Maintain and restore healthy ecosystems and watersheds, which preserve functional links among ecosystem elements to ensure the continued persistence, health, and diversity of all species including game fish species, non-game fish species, and other organisms.
3. Protect and expand habitat and ecosystem functions as the means to significantly increase the abundance, productivity, and life history diversity of resident fish at least to the extent that they have been affected by the development and operation of the hydrosystem.

4. Achieve population characteristics of these species within 100 years that, while fluctuating due to natural variability, represent on average full mitigation for losses of resident fish.

2.0 BIOLOGY AND STATUS

2.1 Species Description

The white sturgeon (*Acipenser transmontanus*) is one of seven North American and 23 total sturgeon species that inhabit temperate large river systems throughout the Northern Hemisphere (Robins et al. 1980). The white sturgeon was initially described by Richardson in 1863 from a specimen collected in the Columbia River near Fort Vancouver, Washington (Scott and Crossman 1973). Green sturgeon (*Acipenser medirostris*) are also found in the Columbia River but are restricted to coastal areas (Scott and Crossman 1973, Brown 1989).

All sturgeon are characterized by a cartilaginous skeleton and persistent notochord (Scott and Crossman 1973). They possess a tube-like mouth and four barbels located on the ventral surface of a hard protruding snout. All sturgeon have five rows of bony plates (scutes): one dorsal, two ventral, and two lateral (Scott and Crossman 1973). Denticles make the skin feel rough between the rows of scutes. The arrangement and number of scutes are diagnostic for white sturgeon: 11 to 14 dorsal, 36 to 48 lateral, and 9 to 12 ventral scutes (Scott and Crossman 1973). Bajkov (1955) also described white sturgeon with seven rows of scutes. About 3% of the specimens examined displayed this characteristic and were collected downstream from Bonneville Dam, the lowermost dam on the Columbia River. White sturgeon with seven rows of scutes also have been recorded in the Columbia River.

Several authors have noted snout dimorphism in white sturgeon (Crass and Gray 1982; Brannon et al. 1986). Landlocked forms appear to have more pointed snouts than those with access to the ocean (Brannon et al. 1986). Different snout shapes may reflect different temperatures or other factors that individuals experience during development (Ruban and Sokolov 1986, Brannon et al. 1987) or perhaps an adaptation to fast moving water.

2.2 Distribution & Movements

White sturgeon are a facultative anadromous species that inhabits large rivers, estuaries, and the near-shore ocean from Ensenada, Mexico to the Aleutian Islands (Figure 4). Significant white sturgeon populations spawn in the Columbia, Fraser, and Sacramento river systems (Scott and Crossman 1973, Lee et al. 1980, Lane 1991). These populations likely mix in the ocean but only occasional movement of tagged fish has been observed among the three main river systems (DeVore et al. 1999). Many white sturgeon populations and individuals are currently restricted to fresh water by impassable dams or historic natural barriers. Prior to extensive development, populations with access to the ocean probably included a mixture of anadromous and resident life histories with the incidence of anadromy decreasing in the upper river reaches.

White sturgeon historically had access from the ocean all the way to Windermere Lake in the upper Columbia and Shoshone Falls in the upper Snake River (Figure 4). Populations in the upper reaches of the basin were most likely resident but benefited from the availability of anadromous salmon. A Kootenay River population was isolated upstream of Bonnington Falls since the last glaciation approximately 10,000 years ago (Northcote 1973). White sturgeon inhabited the upper Columbia mainstem, lower Spokane River, lower Pend d'Oreille River, and