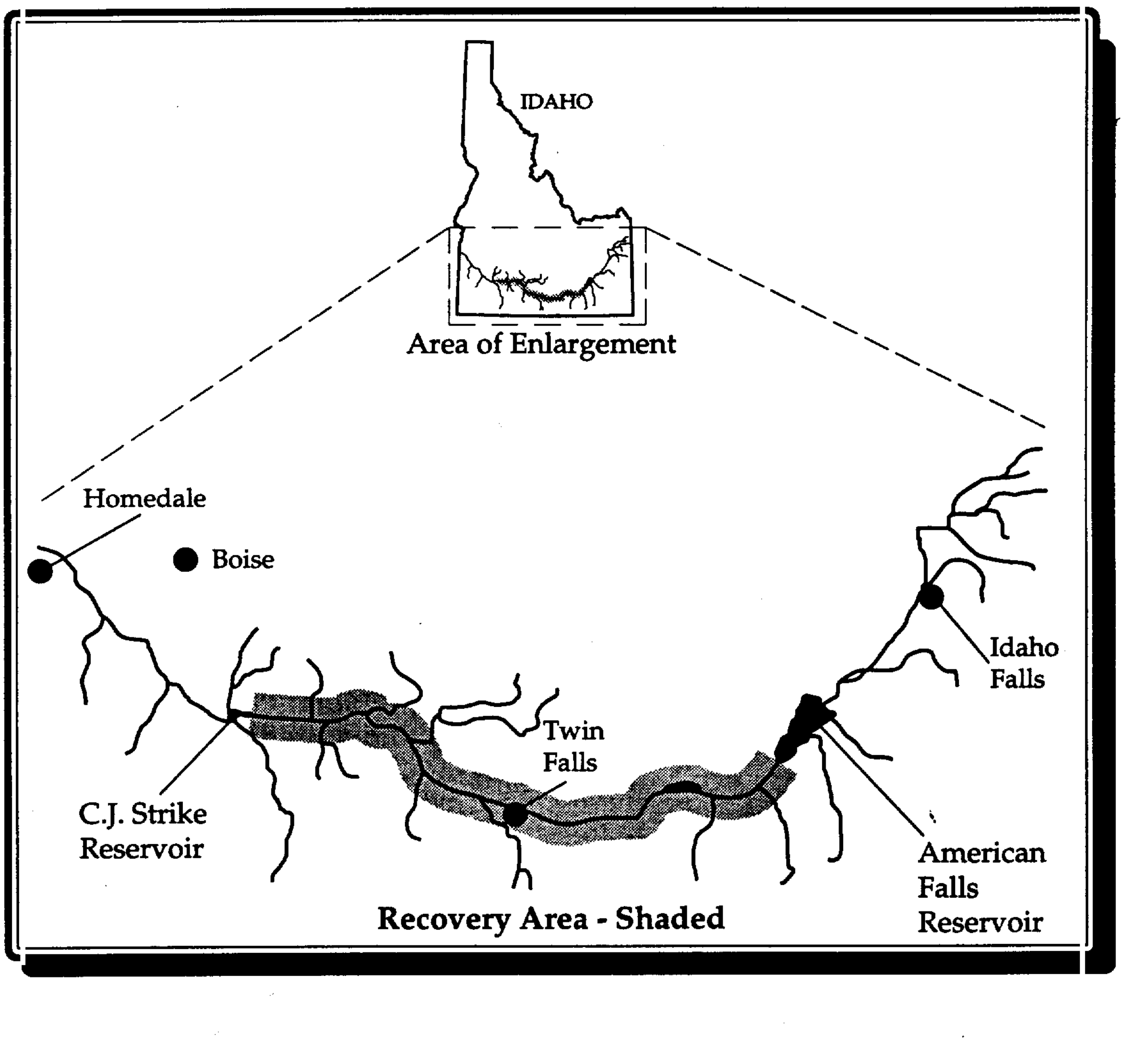
Snake River Aquatic Species Recovery Plan

December 1995



U.S. Fish and Wildlife Service, Pacific Region

SNAKE RIVER AQUATIC SPECIES

RECOVERY PLAN

December 1995

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Regional Director, U.S. Fish and Wildlife Service

Date: 11/26/95

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Recovery plans delineate actions which are believed to be required to recover and/or protect the species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. Recovery plans represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings~~, changes~~ in species status, and the completion of recovery tasks.

LITERATURE CITATION: U.S. Fish and Wildlife Service. 1995. Snake River Aquatic Species Recovery Plan. Snake River Basin Office, Ecological Services, Boise, Idaho. 92 pp.

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EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR SNAKE RIVER AQUATIC SPECIES IN SOUTH CENTRAL IDAHO

Current Status: The middle Snake River from C.J. Strike Reservoir to American Falls Dam provides habitat for the 5 Snake River snails listed as threatened (the Bliss Rapids snail) or endangered (the Snake River physa, Banbury Springs lanx, Utah valvata snail, and Idaho springsnail) under the Federal Endangered Species Act. With the arrival of exploration and development, the Snake River ecosystem has undergone significant transformation from a primarily free-flowing, cold-water system to a slower-moving and warmer system. At present, the listed species occur mainly in the remaining free-flowing reaches or spring alcove habitats of the Snake River.

Habitat Requirements and Limiting Factors: Ecologically, the 5 listed species share many characteristics, and in some locations two or more can be found sharing the same habitat. Their habitat requirements generally include cold, clean, well-oxygenated flowing water of low turbidity. With the exception of Utah valvata and possibly the Idaho springsnail, the listed snails prefer gravel-to-boulder size substrate. Despite these affinities, each of the 5 species has slightly different habitat preferences. The Idaho springsnail and Snake River physa are found only in the free-flowing mainstem Snake River. The Bliss Rapids snail and Utah valvata occur in both cold-water springs or mainstem habitats, while the Banbury Springs lanx only occurs in cold-water springs. The fauna dependent on free-flowing reaches of the middle Snake River have been declining since the early 19th century due to fragmentation of remaining free-flowing habitats and deteriorating water quality.

Recovery Objectives: The short-term recovery objectives of this recovery plan are to protect known live colonies of the federally listed snails by eliminating or reducing known threats. The long-term objectives are to restore viable, self-reproducing colonies of the 5 listed snails within specific geographic ranges (referenced under Recovery Criteria below) to the point that they are delisted.

Recovery Criteria: The 5 federally listed snails may be reclassified or recovered by implementing various conservation measures that preserve and restore both mainstem Snake River and tributary cold-water spring habitats. These habitats are essential to their survival within the specified recovery areas described below. The Snake River Aquatic Species Recovery Plan (Plan) identifies specific recovery areas and short-term recovery goals that will provide downlisting/delisting criteria for each of the 5 listed species. Recovery will be based on detection of increasing, self-reproducing colonies at preselected monitoring sites within each species recovery area for a 5-year period. Monitoring sites selected will generally reflect areas of known live snail collections from the past 15 years and will be located to represent the outer most boundaries of the recovery area for each species.

- o **Idaho springsnail**:
  - The recovery area (see Figure 2) includes the mainstem Snake River between river kilometer (rkm) 834 to 890 (river mile (rm) 518 to 553).

- o **Utah valvata snail**:
  - The recovery area (see Figure 3) includes the mainstem Snake River and tributary cold-water spring complexes between rkm 932 to 1142 (rm 572 to 709).

- o **Snake River physa**:
  - The recovery area (see Figure 4) includes the mainstem Snake River between rkm 890 to 1086 (rm 553 to 675).

- o **Bliss Rapids snail**:
  - The recovery area (see Figure 5) includes the mainstem Snake River and tributary cold-water spring complexes between rkm 880 to 942 (rm 547 to 585).

- o **Banbury Springs lanx**:
  - The recovery area (see Figure 6) and monitoring sites for Banbury Springs lanx includes tributary cold-water spring complexes to the Snake River between rkm 941.5 to 948.8 (rm 584.8 to 589.3).

Actions Needed to Initiate Recovery:

1. Ensure water quality standards for cold-water biota and habitat conditions so that viable, self-reproducing snail colonies are established in free-flowing mainstem and cold-water spring habitats within specified geographic ranges, or recovery areas, for each of the 5 species. Snails detected at the sites selected for monitoring will be surveyed on an annual basis to determine population stability and persistence, and verify presence of all life history stages for a minimum of 5 years.

2. Develop and implement habitat management plans that include conservation measures to protect cold-water spring habitats occupied by Banbury Springs lanx, Bliss Rapids snail, and Utah valvata snail from further habitat degradation (i.e. diversions, pollution, development) as described in Action #1.

3. Stabilize the Snake River Plain aquifer to protect discharge at levels necessary to conserve the listed species cold-water spring habitats.

4. Evaluate the effects of non-native flora and fauna on listed species in the Snake River from C.J. Strike Dam to American Falls Dam.

Estimated Cost of Recovery: Partial costs (in $1,000's) are estimated for some of the tasks/needs for the first 5 Federal fiscal years (FY) beginning in 1995; each fiscal year begins on October 1.

Year	Priority 1	Priority 2	Priority 3	Total
1995	217	132	45	394
1996	280	2	43	325
1997	175	2	92	269
1998	15	2	96	113
1999	0	2	60	62
	687	140	336	1163

Date of Recovery: Delisting could be initiated within 10 years if recovery criteria have been met.

LIST OF SYMBOLS AND ABBREVIATIONS

ac-ft	acre-feet
ACEC	Area of Critical Environmental Concern
ACP	Agricultural Conservation Program
Act	Endangered Species Act
Agreement	Joint Agreement Regarding Fish and Wildlife Studies
Ag Plan	Agricultural Pollution Abatement Plan
AWQAC	Agricultural Water Quality Advisory Committee
BLM	U.S. Bureau of Land Management
BMP	best management practices
BPA	U.S. Bonneville Power Administration
BR	U.S. Bureau of Reclamation
C	centigrade
cfs	cubic feet per second
cm	centimeter
cm/s	centimeters/second
COE	U.S. Army Corps of Engineers
Council	Northwest Power Planning Council
CWA	Federal Clean Water Act
DEQ	Idaho Department of Health and Welfare - Division of Environmental Quality
EPA	U.S. Environmental Protection Agency
ES	Ecological Services, U.S. Fish and Wildlife Service
FERC	U.S. Federal Energy Regulatory Commission
FSA	Farm Services Agency
ft	feet
ft^2	square feet
ft/s	feet/second
ft/mi	feet/mile
FY	Fiscal Year
IDA	Idaho Department of Agriculture
IDFG	Idaho Department of Fish and Game
IDHW	Idaho Department of Health and Welfare
IDWR	Idaho Department of Water Resources
IWRB	Idaho Water Resource Board
in	inch
IPC	Idaho Power Company
ISU	Idaho State University, Department of Biological Sciences
IWRRI	Idaho Water Resources Research Institute
kg	kilogram
km	kilometer
lbs	pounds
m	meter
m^2	square meter
m^3	cubic meters
m^3/s	cubic meters per second
m/km	meter/kilometer

mg/l	milligrams/liter
mi	mile
mi^2	square miles
mm	millimeter
NWQA	National Water Quality Assessment Program
NMFS	U.S. National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NMP	Nutrient Management Plan
NRCS	Natural Resources Conservation Service
P.L.	Public Law
Plan	Snake River Aquatic Species Recovery Plan
Preserve	The Nature Conservancy's Thousand Springs Preserve
PRI	Private Party or Landowner
PSMFC	Pacific States Marine Fisheries Commission
RC&D	Resource Conservation and Development
Refuge	U.S. Fish and Wildlife Service-National Wildlife Refuge
rkm	river kilometer
rm	river mile (english)
SC	Species of Concern (Federal designation)
Service	U.S. Fish and Wildlife Service (Region 1, Portland, Oregon is the responsible region)
SSC	Species of Special Concern
State	State of Idaho
SWCD	Soil and Water Conservation Districts
TL	total length
TMDL	total maximum daily load
TNC	The Nature Conservancy
Tribe	Shoshone-Bannock Tribes
U of I	University of Idaho
U.S.	United States
USGS	U.S. Geological Survey

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What is a recovery plan? A recovery plan is a template for the recovery of a threatened or endangered species and its habitat. Recovery is the cornerstone and ultimate purpose of the endangered species program. It is the process by which the decline of endangered or threatened species is arrested or reversed, and threats to survival are neutralized. The goal of recovery planning is to restore listed species to the point where they are secure, self-sustaining components of their ecosystem leading to eventual delisting.

A recovery plan is not a decision document but is intended to provide information and guidance that the U.S. Fish and Wildlife Service (Service) believes will lead to recovery of a species and its habitat. The recovery plan provides a combination of information related specifically to the species as well as on-going or proposed actions that may or may not aid in the recovery of the species. Information gaps are given the highest priority for actions needed. Many of the actions, or tasks, will require further environmental analysis and public review, especially those actions taken by Federal agencies.

This recovery plan is primarily a guidance document for the recovery of the 5 federally listed middle Snake River snails and the ecosystem upon which they depend. Because of the difficulty in separating the recovery of these 5 species from recovery of the ecosystem (the middle Snake River), the Service has taken a holistic approach and included other sensitive species (e.g. species of concern) with declining habitat that are dependent upon the same system. It is our hope that the efforts taken now for the 5 listed species will aid the recovery of other sensitive native species before their status becomes critical. However, only those actions that will directly benefit the listed species are given a high priority. Included in the recovery plan are other low priority actions which, if implemented, could benefit non-listed species and contribute to ecosystem recovery.

What is the Snake River ecosystem? An ecosystem is defined as an ecological community together with its environment, functioning as a unit. For the purposes of this recovery plan, the middle Snake River ecosystem is defined as the complex community of plants and animals, both aquatic and terrestrial, that occupy the region of the Snake River from American Falls Dam downstream to C.J. Strike Reservoir, a river reach of approximately 321.8 km (200 mi). This ecosystem includes the physical (abiotic) processes that link and drive the biological (biotic) component such as energy conversion, decomposition and nutrient recycling. Ecosystem management requires integrated management of all lands within this boundary that are connected by these biotic and abiotic linkages.

Without consideration of the entire middle Snake River, it will be difficult to achieve full recovery for listed species. These species are an integral part of the ecosystem and are indicators of the health of that system. Their distribution and current status are directly influenced by ongoing activities affecting the aquatic ecosystem. An important goal of this recovery plan is to improve water quality for cold-water biota. Improvements in water quality will enhance the survival of the listed species, in addition to a multitude of native plant and animal species. Additionally, by addressing the habitat needs of other sensitive species in this recovery plan, the Service will begin to proactively seek solutions that will recover these species before it is too late.

'The last word in ignorance is the man who says of an animal or plant: 'What good is it?' If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering.' -Aldo Leopold, Round River

PART I - INTRODUCTION

A. OVERVIEW

On December 14, 1992, the Service added 5 aquatic snails from the Snake River in south central Idaho to the Federal list of Threatened and Endangered Wildlife (57 FR 59244). The Service determined the Idaho springsnail or Homedale Creek springsnail (Pyrgulopsis idahoensis), the Utah valvata snail (Valvata utahensis), Snake River physa snail (Physa natricina), and the undescribed Banbury Springs lanx in the genus Lanx as endangered; and the Bliss Rapids snail (Taylorconcha serpenticola) as threatened.

Habitat elements important to the continued survival of these species include cold, unpolluted, well-oxygenated flowing water with low turbidity (or high clarity). These species also prefer gravel-to-boulder size substrate, with the exception of Utah valvata and possibly the Idaho springsnail.

The recovery priority for each of the listed species is as follows:

- Idaho springsnail, Utah valvata, and Snake River physa: The recovery priority for each of these taxa is five C (5C), indicating that: 1) taxonomically, all 3 are species; 2) each species is subject to a high degree of threat; 3) is rated low in terms of recovery potential; and 4) each species has a high degree of potential conflict associated with recovery.

- Bliss Rapids snail: The recovery priority for this taxon is seven C (7C), indicating that: 1) taxonomically, it is a monotypic genus; 2) is subject to a moderate degree of threat; 3) the recovery potential is high; and 4) the degree of potential conflict during recovery is high.

- Banbury Springs lanx: The recovery priority for this taxon is eight (8), indicating that: 1) although taxonomically undescribed, it is believed to be a species; 2) is subject to a moderate degree of threat; and 3) the recovery potential is high.

The Snake River from C.J. Strike Reservoir to American Falls Dam (Figure 1) provides habitat for 25 extant native fish taxa (Appendix A) and at least 42 native molluscs (Appendix B). This includes the 5 listed Snake River snails, as well as 4 additional snails and fish taxa currently considered Species of Concern (SC) by the Service [the California floater (Anadonta californiensis), Columbia pebblesnail (Fluminicola columbiana), Shoshone sculpin (Cottus greenei) and redband trout (Oncorhynchus mykiss gairdneri)], and a State Species of Special Concern (SSC) fish taxon, the white sturgeon (Acipenser transmontanus).

With the advent of exploration and development, the Snake River ecosystem has undergone a significant transformation from a primarily free-flowing, cold-water system to a slower-moving, warmer system. The human-induced environmental stressors to the Snake River include numerous point and nonpoint pollution sources, diversion of water for irrigation or hydropower, and construction of several mainstem dams (see Figure 7). This recovery plan specifically addresses the 5 federally listed Snake River snails (Service 1992). However, the aquatic habitats essential to these listed species and other aquatic species between C.J. Strike and American Falls Dam are similar and cannot be isolated for recovery purposes. Therefore, in order to be successful, this recovery plan and the entire recovery effort are designed to address the middle Snake River ecosystem rather than treating each individual species separately.

For the purposes of this recovery plan, the middle Snake River is defined as the reach between C.J. Strike Reservoir (rkm 834, rm 518) upstream to American Falls Dam (rkm 1,150, rm 714) (Figure 1). Additional information about the location, history, natural history and history of water use of the middle Snake River can be reviewed in Appendix C. For information regarding landmarks and associated river miles/kilometers along the Snake River, see Appendix D.

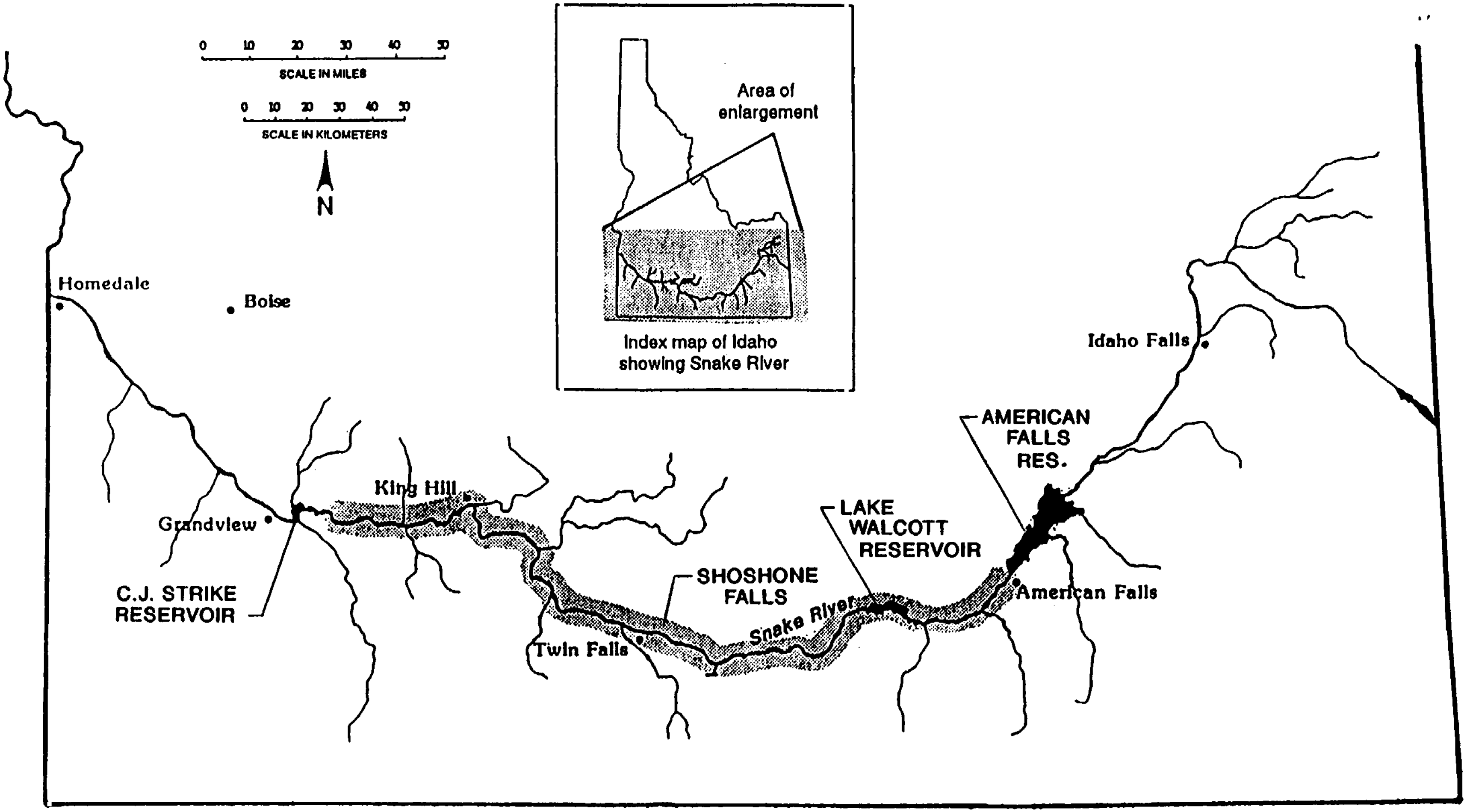

Figure 1. Map of the Snake River in Idaho, shading indicates recovery area for the Snake River Aquatic Species.

B. SPECIES ACCOUNTS

The 5 federally listed species, Idaho springsnail, Utah valvata snail, Snake River physa snail, Bliss Rapids snail, and Banbury Springs lanx are part of the native mollusc fauna of the Snake River which characteristically require cold, fast water or lotic habitats. Many of the 42 known species of molluscs in the middle Snake River are widely distributed and are somewhat tolerant of pollution; the 5 listed snails are primarily limited to the Snake River basin below American Falls Dam, and are generally intolerant of pollution.

Based on the fossil record, 4 of the listed snails are endemic to the Pliocene Lake Idaho region and its Pleistocene successors (Frest 1991a). In general, the fossil record shows a larger historic than current distribution, with historic populations considered to be continuous throughout their range. An exception is the Banbury Springs lanx, an obligate spring species with no known fossil records; according to Frest (1991a), each geographically isolated spring could be considered a different population.

IDAHO SPRINGSNAIL (endangered)

Using specimens collected by H.M. Tucker in 1930, near Homedale, Idaho, H.A. Pilsbry (1933) first described the Idaho springsnail as Amnicola idahoensis. In 1965, Gregg and Taylor (1965) revised the genus Amnicola into a new genus Fontelicella. Later Hershler and Thompson (1987) assigned Fontelicella to the genus Pyrgulopsis.

The Idaho springsnail has a narrowly elongate shell reaching a height of 5 to 7 millimeters (mm) [0.2 to 0.25 inches (in)], with up to 6 whorls. This species is found only in permanent flowing waters of the mainstem Snake River; the snail is not found in any of the Snake River tributaries or in marginal cold-water springs (Taylor 1982d). The species is an interstitial ("between" or within spaces) dweller occurring on mud or sand with gravel-to-boulder size substrate. Its life history requirements have not been throughly investigated.

The springsnail is a Lake Idaho endemic, and in fossil form has the same potential relict range as the Bliss Rapids snail (Frest 1991a). Historically, the Idaho springsnail was found from Homedale (rkm 670, rm 416) to Bancroft Springs (rkm 890, rm 553) and has been collected at 10 locales (Figure 2).

At present, the species is discontinuously distributed in the mainstem Snake River at a few sites near the headwaters of C. J. Strike Reservoir (rkm 834, rm 518) upstream to Bancroft Springs (rkm 890, rm 553), a reduction of nearly 80% from its historic range (Figure 2). This species has declined in numbers and the remaining populations are small and fragmented.

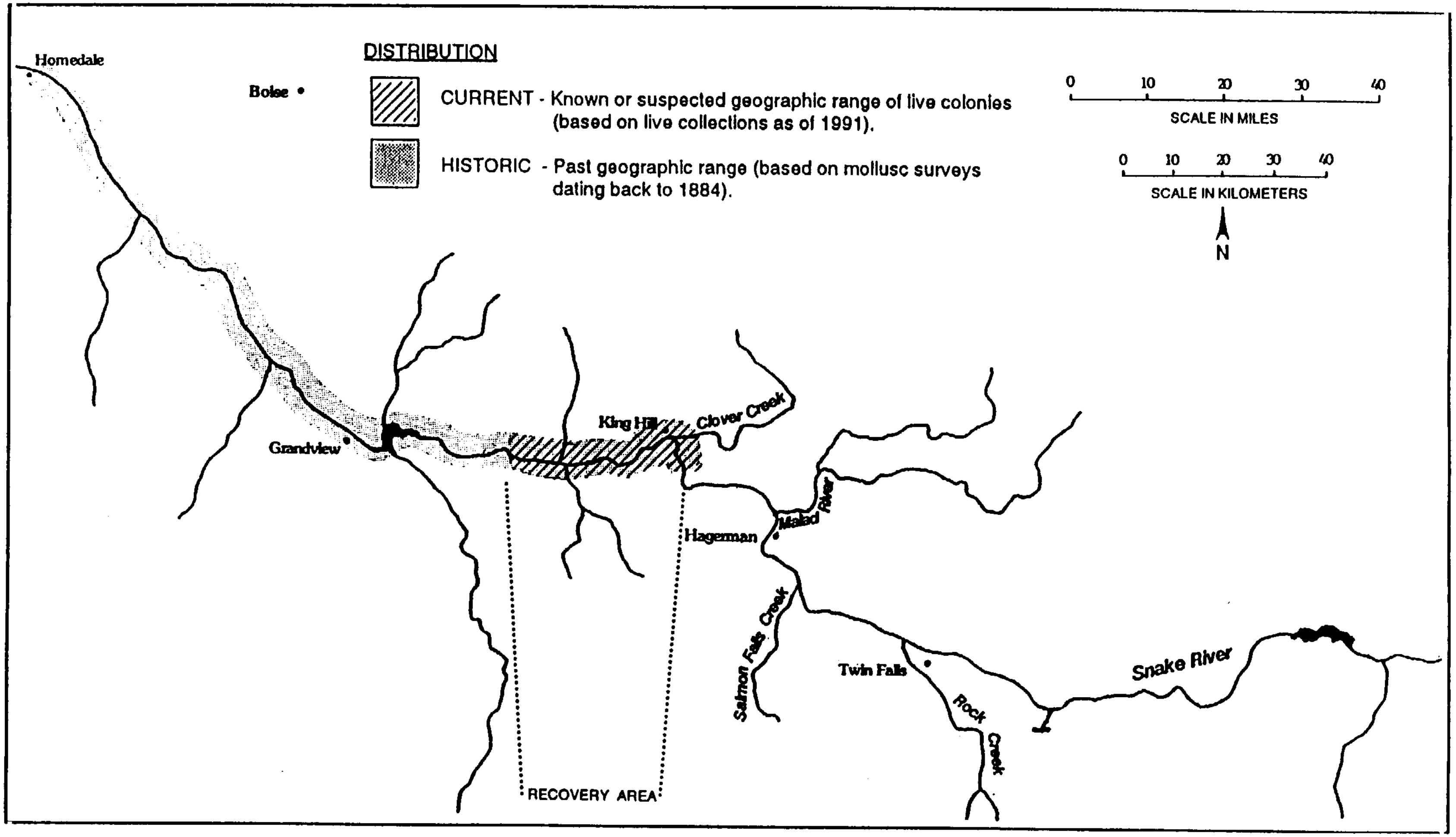

Figure 2. Idaho springsnail (Pyrgulopsis idahoensis) current and historic distribution within the Snake River drainage in Idaho. The springsnail is currently discontinuously distributed only in the mainstem Snake River. The recovery area includes the aquatic ecosystem where suitable habitat is restored and self-reproducing colonies are established.

UTAH VALVATA SNAIL (endangered)

Call (1884) first described this species as Valvata sincera var. utahensis from specimens collected at Utah Lake, Utah. Walker (1902) revised the genus and elevated V. utahensis to species level.

The Utah valvata snail is 4.5 mm (0.2 in) high, and the shell is turbinate (about equally high and wide) with up to 4 whorls.

In the Snake River, V. utahensis inhabits areas between sand and silt/mud grains, in shallow shoreline water and in pools adjacent to rapids or in perennial flowing waters associated with large spring complexes. The species avoids areas with heavy currents or rapids. The snail prefers well-oxygenated areas of limestone mud or mud-sand substrate among beds of submergent aquatic vegetation. It is absent from pure gravel-boulder substrate. Chara, a rooted aquatic plant that concentrates both calcium carbonate ($CaCO_3$) and silicon dioxide (SiO_2), is a common associate of V. utahensis. V. utahensis is primarily a detritivore, grazing along the mud surface ingesting diatoms or small plant debris. In habitats with boulders on mud, the snail has been observed grazing diatoms and other periphyton (sessile organisms that live attached to rocky surfaces) and aquatic plants.

Valvata utahensis occurred historically in Utah Lake and in the Snake River of southern Idaho (Taylor 1987) (Figure 3). Its modern range extended as far downstream as Grandview (rkm 783, rm 487) (Taylor 1987). Recent mollusc surveys throughout Utah revealed no live snails, and the species is believed to be extirpated there (Clarke 1991).

At present, this species occurs in a few springs and mainstem Snake River sites in the Hagerman Valley (rkm 932, rm 579). Additional locations include a few sites immediately upstream and downstream of Minidoka Dam (rkm 1,086, rm 675), near Eagle Rock damsite (rkm 1,142, rm 709) and below American Falls Dam downstream to Burley (Taylor 1987) (Figure 3). Recent surveys at The Nature Conservancy's (TNC) Thousand Springs Preserve (Preserve) revealed declines in numbers and range of Utah valvata over a four-year period (Frest and Johannes 1992). In 1991, colonies of this snail persisted in only two areas at the Preserve with a population estimate for each colony at or below 6,000 individuals. Population density varied but averaged six individuals per quarter meter^2 (2.69 ft^2).

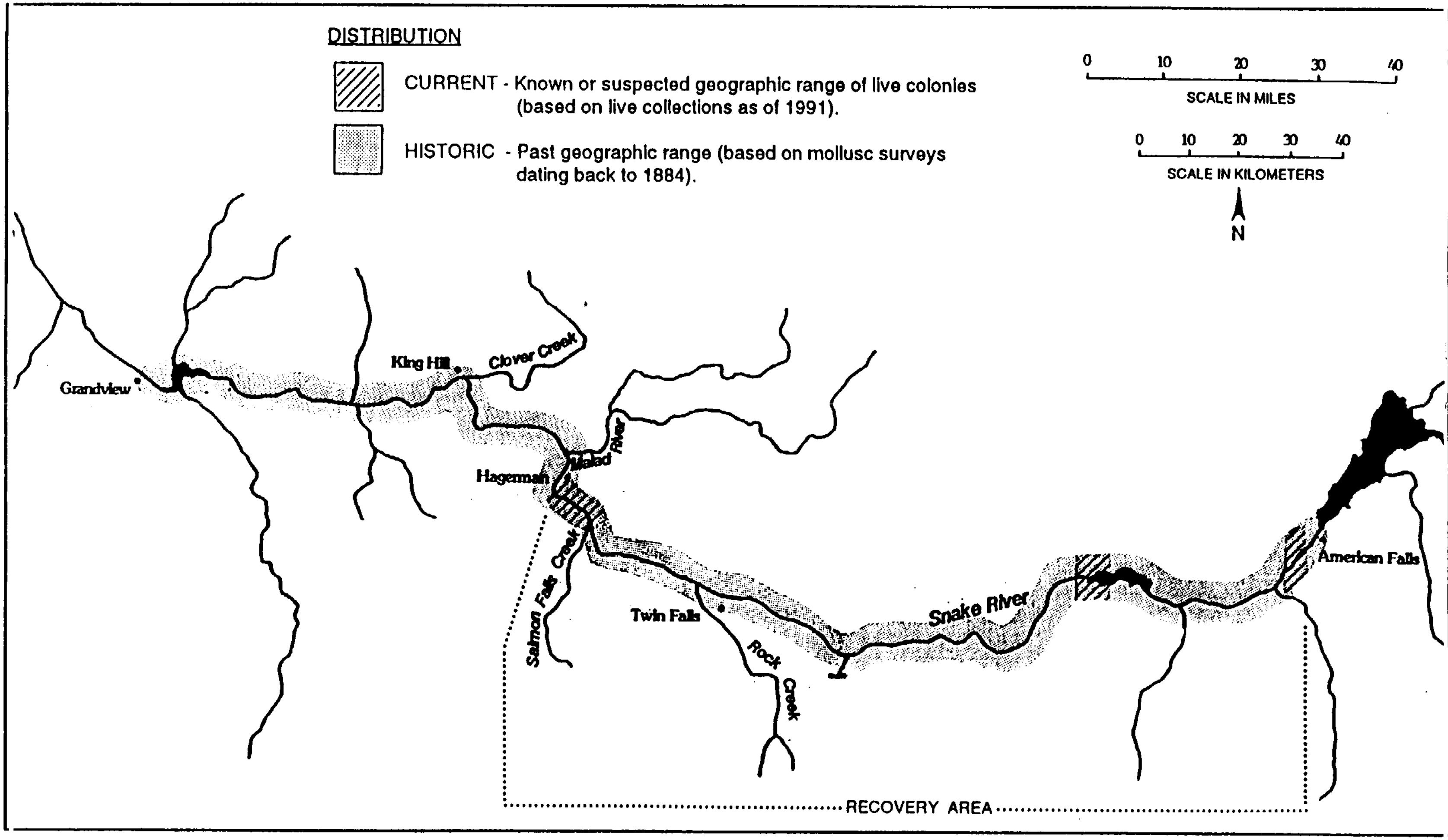

Figure 3. Utah valvata (Valvata utahensis) current and historic distribution within the Snake River drainage in Idaho. The snail occurs in both the mainstem Snake River and adjacent cold-water springs. The recovery area includes the aquatic ecosystem where suitable habitat is restored and self-reproducing colonies are established.

SNAKE RIVER PHYSA SNAIL (endangered)

The Snake River physa snail was named Physa natricina and described by Taylor (1988). Fossil records of the species occur in deposits from Pleistocene-Holocene lakes and rivers from southeastern Idaho and northern Utah.

The shells of adult Snake River physa snails are about 5 to 7 mm (0.2 to 0.25 in) high with 3 to 3.5 whorls and are amber to brown in color. The species occurs on the undersides of gravel-to-boulder size substrate in swift current in the mainstem Snake River. Living specimens have been found on boulders in the deepest accessible part of the river at the margins of rapids. Taylor (1982c) believed much of the habitat for this species was in deep water beyond the range of routine sampling.

Taylor (1988) cites collections of this species from 1956 through 1985 and considers its "modern" historic range in the Snake River to extend from Grandview (based on empty shells) upstream through the Hagerman Reach (rkm 917, rm 573) (Figure 4). Taylor (1988) stated that the Grandview sub-population was extirpated in the early 1980's "... as the native bottom fauna has been virtually eliminated in this segment of the Snake River." The Snake River physa was also recorded below Minidoka Dam (rkm 1,086, rm 675) in 1987 (Pentec 1991a). However, recent comprehensive snail surveys in southeastern Idaho and northern Utah (Frest et al. 1991) and in a free-flowing reach near Buhl (Frest and Johannes 1992) failed to find live specimens. At present, two populations (or colonies) are believed to remain in the Hagerman and King Hill reaches, with possibly a third colony immediately downstream of Minidoka Dam (Figure 4). Live Snake River physa snails are always rare at collection sites; it is believed that fewer than 50 live Snake River physa have been collected in the Snake River (Frest et al. 1991).

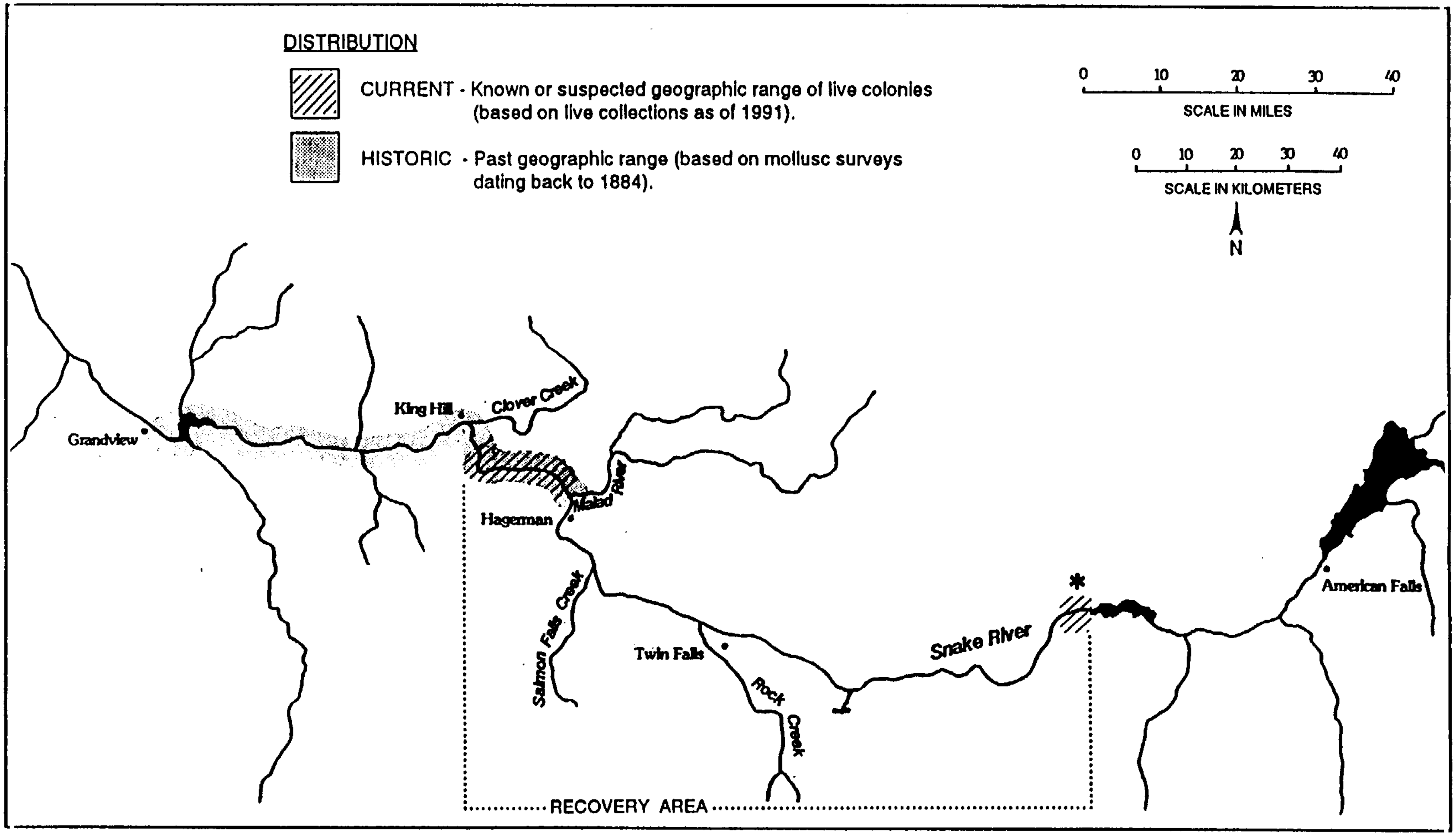

Figure 4. Snake River physa (Physa natricina) current and historic distribution within the Snake River drainage in Idaho. The physa is currently discontinuously distributed only in the mainstem Snake River. The recovery area includes the aquatic ecosystem where suitable habitat is restored and self-reproducing colonies are established.
✱ Recorded live below Minidoka Dam in 1987.

BLISS RAPIDS SNAIL (threatened)

The Bliss Rapids snail (Taylorconcha serpenticola) was formally described by Hershler et al. (1994). It was first collected live and recognized as a new taxon in 1959 (Taylor 1982a).

The Bliss Rapids snail is 2.0 to 2.5 mm (0.1 in) in height, with three whorls, and is roughly ovoid in shape. There can be two color variants in the Bliss Rapids snail, the colorless or "pale" form and the orange-red or "orange" form. The pale form is slightly smaller with rounded whorls and with more melanin pigment on the body (Frest and Johannes 1992).

This snail occurs on stable cobble-boulder size substrate in flowing waters of unimpounded reaches of the mainstem Snake River and in a few spring habitats in the Hagerman Valley. The species does not burrow in sediments and normally avoids surfaces with attached plants. Known river populations of the Bliss Rapids snail occur only in areas associated with spring influences or rapids-edge environments and tend to flank shorelines. They are found at varying depths if dissolved oxygen and temperature requirements persist and are found in shallow (< 1 centimeter (cm), 0.5 in) depth, permanent, cold springs (Frest and Johannes 1992). The species is considered moderately negatively phototaxic and resides on the lateral sides and undersides of rocks during daylight (Bowler 1990). The species can be locally quite abundant, especially on smooth rock surfaces with common encrusting red algae.

The Bliss Rapids snail was known historically from the mainstem middle Snake River and associated springs between Indian Cove Bridge (rkm 845.9, rm 525.4) and Twin Falls (rkm 982.9, rm 610.5) (Hershler et al. 1994) (Figure 5). Taylor (1982b) believed that "...prior to dam construction there was probably a single population throughout this range, and plausibly upstream as well." Localities extant subpopulations have been reported by Taylor (1987) and Frest (1991a). Pentec (1991b) likely extended the present, known range of the species upstream approximately 259.2 km (162 mi) when it was found in spring habitats above American Falls Reservoir (rkm 1,207.1, rm 749.8). This highly disjunct upstream record requires further verification (Hershler et al. 1994). Based on live collections, the species currently exists as discontinuous populations within its historic range (Figure 5). These colonies are primarily concentrated in the Hagerman reach, in tailwaters of Bliss and Lower Salmon Dams and several unpolluted springs [including Thousand Springs, Banbury Springs, Box Canyon Springs (Figure 6) and Niagara Springs.

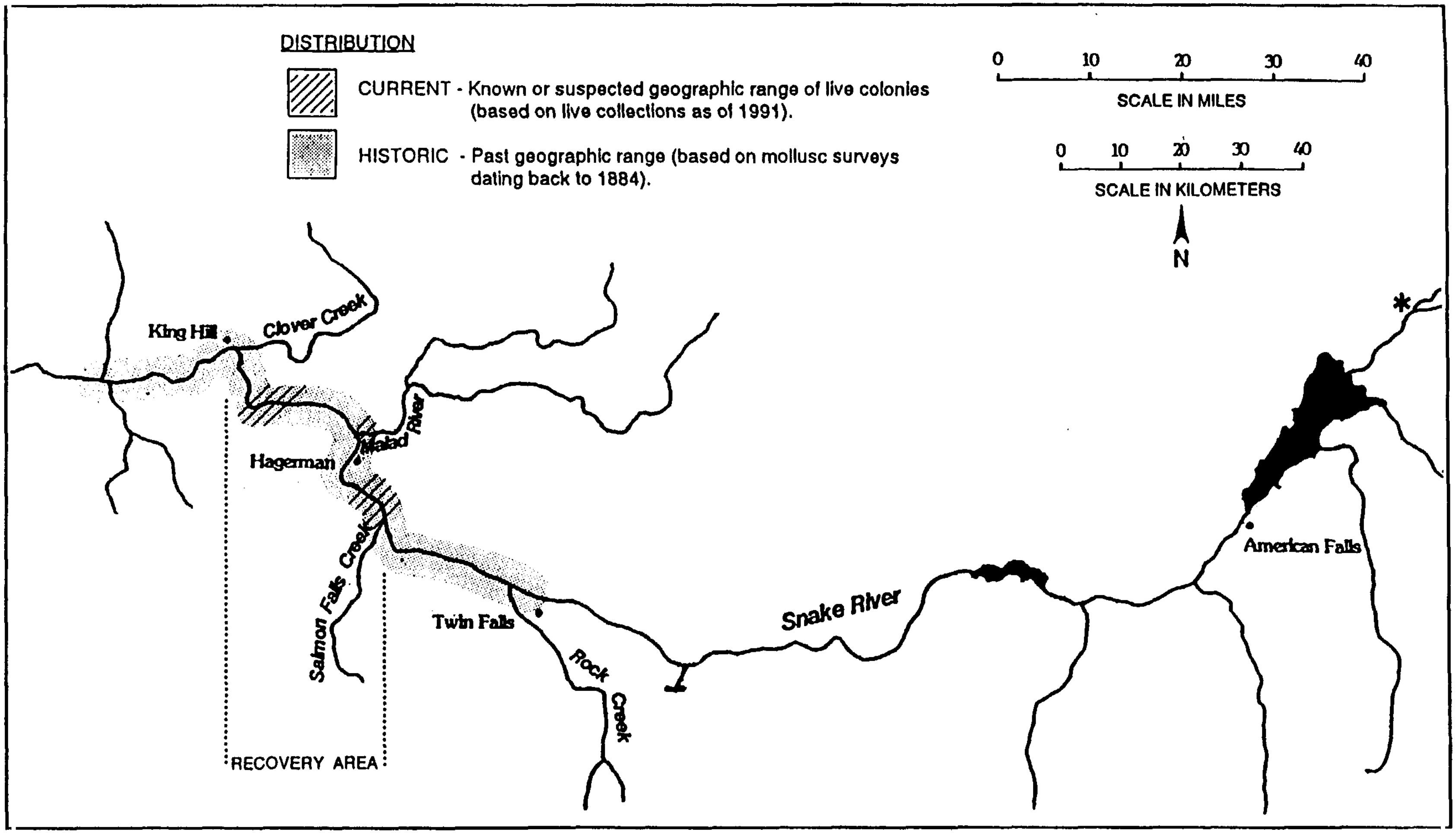

Figure 5. Bliss Rapids snail (Taylorconcha serpenticola) current and historic distribution as well as proposed recovery area within the Snake River drainage in Idaho. The snail occurs in both the mainstem Snake River and adjacent cold-water springs. The recovery area includes the aquatic ecosystem where suitable habitat is restored and self-reproducing colonies are established.

* Denotes the occurrence of a disjunct population near the confluence with the Blackfoot River.

BANBURY SPRINGS LANX (endangered)

This snail is a member of Lancidae, a small family of pulmonates (snails that possess lung-like organs) endemic to western North America. The species was first discovered in 1988 (Frest in litt. 1991b) and has not been formally described. The species is distinguished by a cap-shaped shell of uniform red-cinnamon color with a subcentral apex. Its length [2.4 to 7.1 mm (.09 to .28 in)] and height [1.0 to 4.3 mm (.03 to .17 in)] exceed its width of 1.9 to 6.0 mm (.07 to .24 in).

The species has been found only in spring-run habitats with well-oxygenated, clear, cold {15 to 16° centigrade (C) [59 to 61° fahrenheit (F)]} waters on boulder or cobble-size substrate. All known locations have relatively swift currents. They are found most often on smooth basalt and avoid surfaces with large aquatic macrophytes or filamentous green algae. Beak (1989) reported the species (specimens originally identified as Fisherola nuttalli) at depths ranging from 30 to 75 cm (12 to 30 in) on boulder substrate. Frest and Johannes (1992) found the species in water as shallow as 5 cm (2 in), but depths up to 15 cm (6 in) were more typical. All lancids are particularly affected by dissolved oxygen fluctuations since respiration is accomplished only through the mantle; lungs, gills, and other specialized respiratory structures are lacking (Frest and Johannes 1992). Common snail associates of this species include the threatened Bliss Rapids snail and vagrant pebblesnail (Fluminicola hindsi).

This lanx was first discovered in 1988 at Banbury Springs (rkm 949, rm 589) with a second colony found in nearby Box Canyon Springs (rkm 947, rm 588) in 1989. During 1991, a mollusc survey at TNC's Preserve revealed a third colony in the outflows of Thousand Springs (rkm 941, rm 584.6) (Pentec 1991b) (Figure 6). Subsequent to this discovery, a more detailed investigation at the Preserve revealed that the single colony was sporadically distributed within an area of only 12 to 14 meter^2 (m^2) [129 to 150.7 square feet (ft^2)] (Frest and Johannes 1992). Population density ranged from 4 to 20 individuals/m^2 (43.1 to 215.3 ft^2). The total adult population at the Preserve was estimated at between 600 to 1,200. All three colonies of lanx were discovered in alcove spring complexes. These spring complexes contain large areas of adjacent, presumably identical, habitat not occupied by the species. At present, the Banbury Springs lanx is known to occur only in the largest, least disturbed spring habitats at Banbury Springs, Box Canyon Springs, and Thousand Springs.

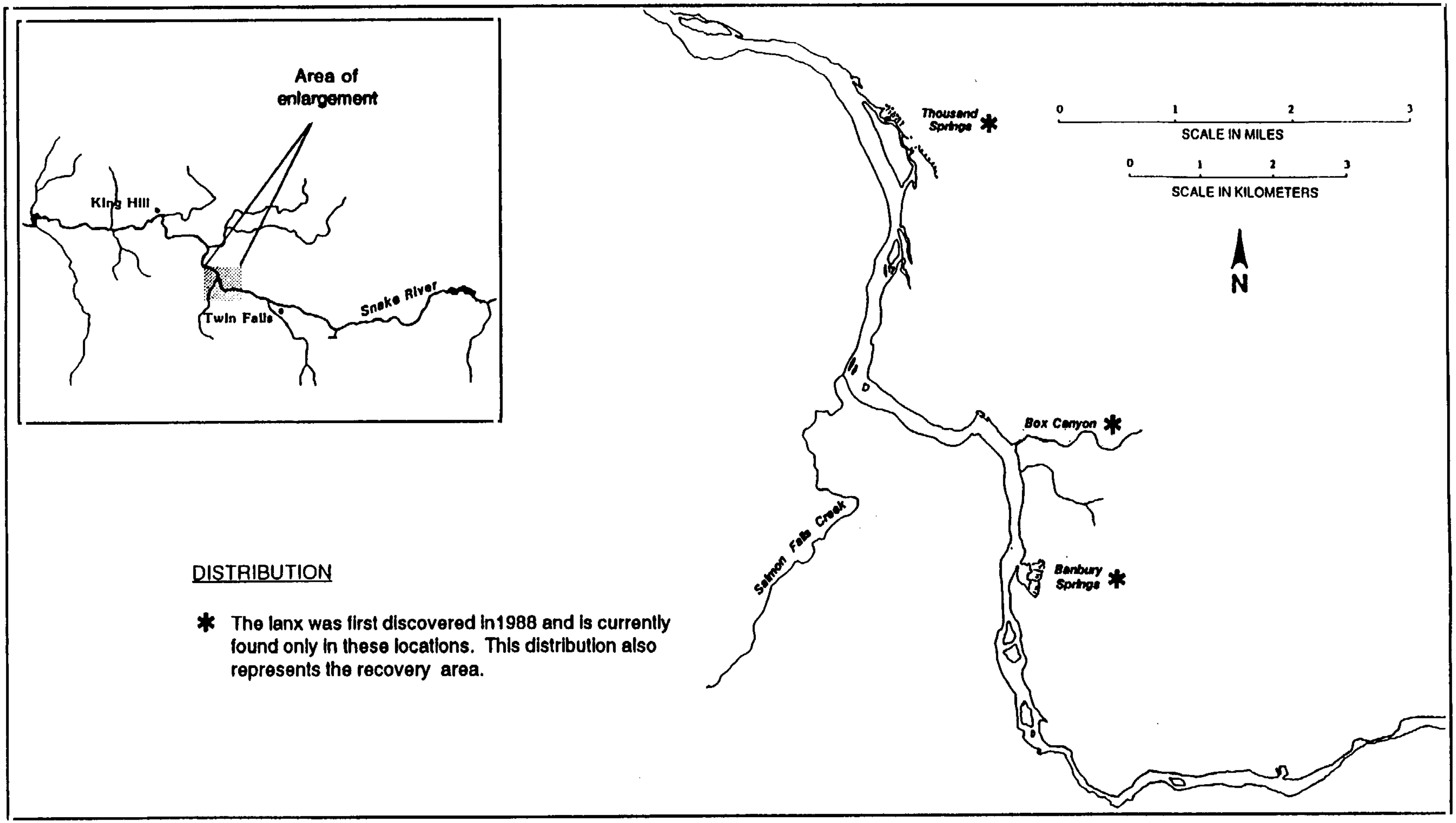

Figure 6. Banbury Springs lanx (Lanx sp.) current distribution within the Snake River drainage in Idaho. The lanx occurs only in these three cold-water spring complexes, and is not found in the mainstem Snake River.

California floater (SC[1])

The California floater (Anodonta californiensis) is a large freshwater mussel in the family Unionidae. According to Frest (1992), this species is most commonly found in rivers, cold-water springs, or reservoirs in relatively stable, oxygenated mud-to-fine gravel beds. In the Snake River, the species is often found immediately upstream or downstream of rapids in mud-sand substrates with good water quality. This mussel is relatively sessile and does not bury itself completely, exposing about 1/3 to 1/2 of the shell, oriented with the anterior margin pointing upstream. Very little is known regarding its life history.

Anodontinids, similar to other North American freshwater mussels, are thin-shelled, relatively fast growing, and can live about 20 years. Anodontinid larvae are also obligate parasites of freshwater fish for a period of several weeks (commonly 3 to 6), and therefore are essentially dependent on fish for distribution. The host fish for Anodonta californiensis is unknown, although other North American Anodonta species exploit fish taxa including sockeye salmon, chinook salmon and three-spined stickleback.

The California floater is known from several sites in Arizona, California, Washington, Oregon, Nevada, Utah and Idaho. The species still occurs in the Snake River at several sites upstream from the King Hill reach (rkm 853, rm 530). However, Frest and Bowler (1992) note a declining trend for this cold-water species likely resulting from the conversion of the Snake River to a slow-moving, warm-water, shallow lake system.

Columbia pebblesnail (SC)

The Columbia pebblesnail (Fluminicola columbiana) is a small snail of the family Hydrobiidae with a turbinate shell that is approximately 10 mm (0.4 in) high. Based on fossil records, "...pebblesnails were widely distributed throughout the Columbia River basin since the Pliocene, about 3.5 million years before present" (Neitzel and Frest 1993).

The pebblesnail lives in flowing waters ranging in size from streams to large river systems (Neitzel and Frest 1993). The species uses gravel-to-boulder size substrate and is common at the edge or downstream of rapids/whitewater areas. They avoid areas with swift currents and are absent in spring systems. The species is an obligate perilithon grazer, feeding primarily upon diatoms and smaller attached algae (Neitzel and Frest 1993). Life history and specific habitat requirements are not well defined.

Prior to 1988, the Columbia pebblesnail was known only from the lower Snake, Columbia, Spokane, Little Spokane, and Payette Rivers. Recently, a single population of this species was discovered in the Snake River in the Wiley Reach upstream of Bliss Dam (Neitzel and Frest 1993).

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[1]SC = species of concern: taxa for which information now in possession of the Service indicates that proposing to list is possibly appropriate but for which conclusive data is not currently available.

Shoshone sculpin (SC)

The Shoshone sculpin (Cottus greenei) was first described as Uranidea greenei by Gilbert and Culver in 1898 (Wallace et al. 1984). The species is also designated as SSC by the Idaho Department of Fish and Game (IDFG).

Shoshone sculpin are distinguished from other Cottidae in having a pre-opercle (part of the gill cover) with a single spine; palatine teeth present in broad bands; a dorsal fin with six spines and 18 to 19 rays; and an anal fin with 12 or 13 rays. Shoshone sculpin typically inhabit cold-water springs characterized by water temperatures less than 17° C (62.6° F), surface velocity less than 40 centimeters/second (cm/s) (1.31 ft/s), and depth less than 80 cm (31.5 in) (Wallace et al. 1981). They are normally associated with cover, either in the form of rocks, cobble, gravel, and/or vegetation (Veronica, Potamogeton and Zanichellia). Young sculpin less than 30 to 40 mm (1.2 to 1.6 in) total length (TL) are often found on sand or mud substrate as long as vegetation is present. They are often abundant in spring reaches with high densities of aquatic invertebrates (chironomids and gammarids), their preferred prey.

Shoshone sculpin become reproductively mature at age 1, with a minimum size at maturity for females around 40 mm (1.6 in) TL. Fecundity is highly variable, known to range from 31 to 117 eggs/female in one spring location (Connolly 1983). They utilize rocky substrates for spawning during the prolonged breeding season ranging from May through July, possibly into August. There is evidence that female sculpin can spawn more than once a year.

Based on recent studies, Shoshone sculpin are known from at least 52 localities in 26 springs/streams along a 55 km (34 mi) reach of the Snake River from above Bliss Dam (rkm 910, rm 565) upstream to the mouth of Crystal Springs (rkm 964, rm 599) [Chris Randolph, Idaho Power Company (IPC), pers. comm. 1993]. Most known localities are along the north bank of the Snake River in spring flows at Thousand Springs (Wallace et al. 1984). Common community associates include the mottled sculpin (Cottus bairdi), and less frequently rainbow trout (Oncorhynchus mykiss), the introduced brown trout (Salmo trutta), and longnose dace (Rhinichthys cataractae).

Redband trout (SC)

The redband trout (Oncorhynchus mykiss gairdneri) is an interior rainbow trout. The historic range of redband trout includes California, Nevada, Oregon, Washington, Idaho, Montana and British Columbia. Behnke (1992) grouped the redbands of southern Idaho with other interior rainbow trout in the Columbia River basin as the Columbia River redband trout. Their range is defined as the Columbia River basin east of the Cascades up to barrier falls on all major tributaries, the upper Fraser River basin, and the upper Mackenzie River (Behnke 1992).

Scientific debate continues over the validity of classifying the redband trout as a subspecies of rainbow trout. The redband has only recently been recognized by management agencies and little status information exists. Genetic analysis is often the only means of positively identifying native redband trout.

Compared with other rainbow trout, the redband trout subspecies of the Columbia River basin have brighter coloration, larger and sparser spots, more-elliptical parr marks and light-colored tips on dorsal, anal and pelvic fins.

The arid-lands redband trout, such as those of the middle Snake River, are able to function at high temperatures. The IDFG has conducted a preliminary examination of the presence of redband trout in southern Idaho waters based on the definition of a redband as "interior rainbow trout found in the absence of cutthroat trout" (Virgil Moore, IDFG, pers. comm. 1994). Redband trout in the recovery area have been confirmed by the IDFG in the following tributaries to the middle Snake River, including C.J. Strike Reservoir: Bennett Creek, Cold Springs Creek, Little Canyon Creek, King Hill Creek, Clover Creek, Jacks Creek and the Bruneau River (Idaho Conservation Data Center 1994).

White Sturgeon (SSC[2])

White sturgeon (Acipenser transmontanus) are found along the Pacific coast of North America and reproduce in at least three large river basins: the Sacramento, Columbia and Fraser rivers. White sturgeon are included in the Family Acipenseridae, which consists of 4 genera and 24 species of sturgeon. The species was first described by Richardson in 1863 from a single specimen collected in the Columbia River near Fort Vancouver, Washington (Scott and Cressman 1973). White sturgeon are the largest freshwater or anadromous fish in North America, reported to grow up to about 820 kilograms (kg) [1,800 pounds (lbs)]. Individuals in landlocked populations are generally much smaller.

White sturgeon are known to be long-lived, with females living from 34 to 70 years (Pacific States Marine Fisheries Commission (PSMFC) 1992). For white sturgeon in general, the size or age of first maturity in the wild is quite variable (PSMFC 1992). Males generally require 15 to 32 years to reach maturity. Only a portion of adult white sturgeon are reproductive or spawn each year, with the frequency between each spawning for females estimated to range from 2 to 11 years. Spawning occurs when the physical environment permits vitellogenesis (egg development) and cues ovulation. White sturgeon are broadcast spawners releasing their eggs and sperm in fast water.

Historically, white sturgeon occurred throughout the Snake River basin upstream to Shoshone Falls (rkm 990, rm 615), which forms an impassable barrier to further migration and movement. The construction of four dams on the Snake River from 1932 to 1952 has effectively isolated white sturgeon, forming three landlocked populations from C.J. Strike Dam (rkm 795, rm 494) to Shoshone Falls. Habitat throughout these reaches ranges from slack water or impoundment conditions to free-flowing rapids. A brief discussion on the present status for each of the three landlocked sturgeon populations is provided below.

C.J. Strike Dam (rkm 795, rm 494) to Bliss Dam (rkm 902, rm 560) White sturgeon are considered more abundant in this reach than upstream of Brownlee Dam. In 1983,

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[2]Species of Special Concern is a State of Idaho designation for native species which are low in numbers, limited in distribution, or have suffered significant habitat losses.

IDFG estimated that 1,500 to 4,300 sturgeon of 60 to 270 cm (24 to 106 in) TL lived in this reach. Reproduction is known to occur in this reach, although reproductive success is not well defined. At present, IPC is conducting a long-term study on the abundance, status and productivity of white sturgeon in this and other impounded reaches of the Snake River. Initial study results indicate the presence of small sturgeon and evidence of annual spawning.

Bliss Dam (rkm 902, rm 560) to Lower Salmon Falls Dam (rkm 923, rm 573) Part of this reach consists of free-flowing water through a steep-walled canyon 122 to 183 meters (m) [400 to 600 feet (ft)] deep. Although present, sturgeon are not considered abundant or reproductively viable. IPC's sturgeon studies should provide additional information on their present status in this reach. In 1989, IDFG began an experimental sturgeon release program to evaluate growth and survival in this reach where recruitment seems limited (PSMFC 1992). IDFG released sturgeon at a rate of 100 fish/km (161 fish/mi) to compare their growth and survival with sturgeon released at a rate of 10 fish/km (16 fish/mi) into the C.J. Strike to Bliss Dam reach.

Lower (923 rkm, 573 rm) and Upper Salmon Falls (936 rkm, 581 rm) to Shoshone Falls (990 rkm, 615 rm) Between Shoshone Falls and the Upper Salmon Falls impoundment, the Snake River is essentially free-flowing. Flow can fluctuate dramatically, especially during the irrigation season when flows below Milner Dam (which controls river flow at Shoshone Falls) may decrease to zero. Sturgeon are present in low numbers and reproductive viability is not well known.

C. REASONS FOR DECLINE

The free-flowing, cold-water environments required by the listed Snake River species have been affected by, and are vulnerable to, continued adverse habitat modification and deteriorating water quality from one or more of the following: hydroelectric development (Figure 7), load-following (the practice of artificially raising and lowering river levels to meet short-term electrical needs by local run-of-the-river hydroelectric projects) effects of hydroelectric project operations, water withdrawal and diversions, water pollution, inadequate regulatory mechanisms (which have failed to provide protection to the habitat used by the listed species), and the possible adverse affects of exotic species.

Seven proposed hydroelectric projects (Figure 7), including two high-dam facilities, potentially threaten remaining free-flowing river reaches between C.J. Strike and

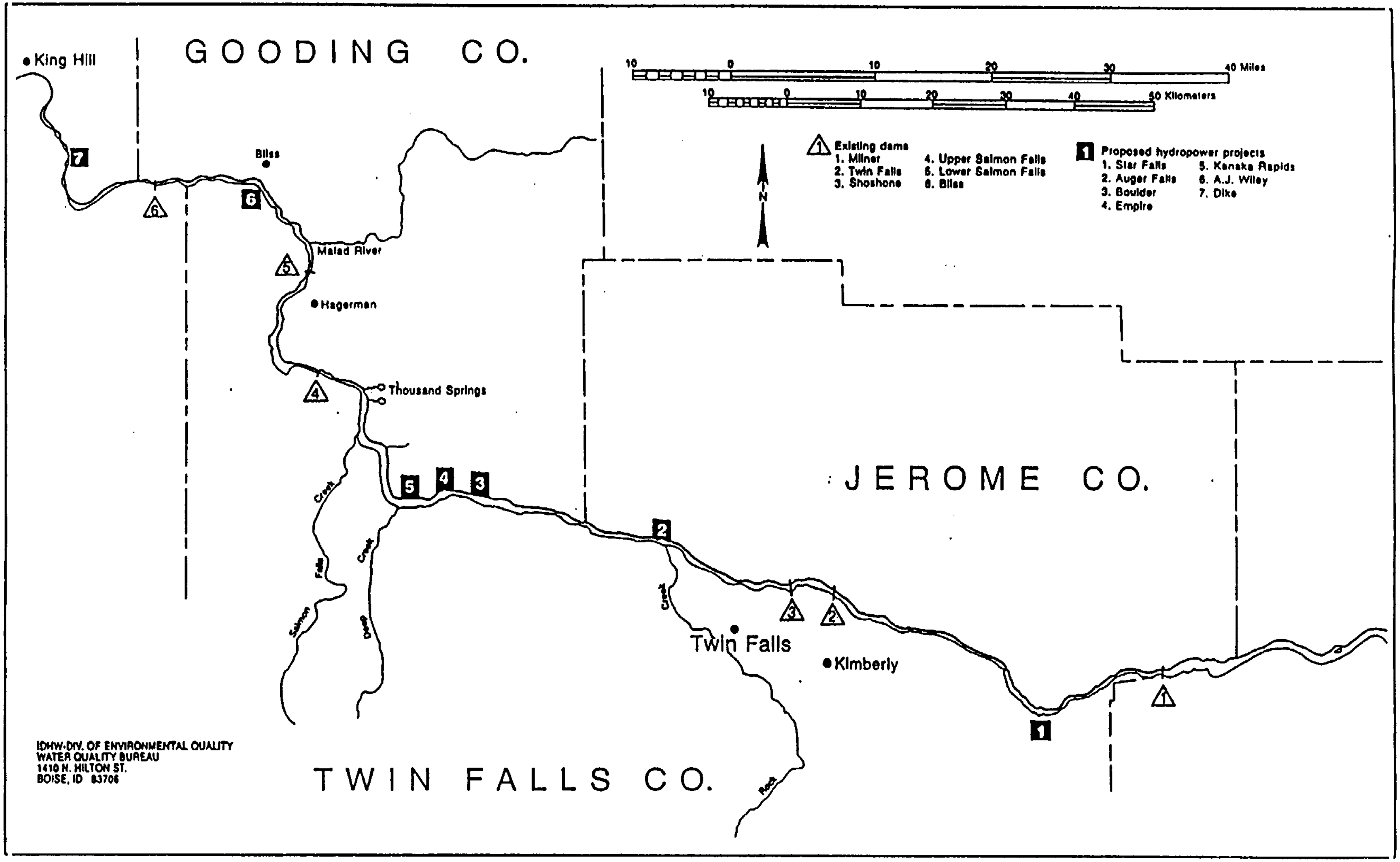


Figure 7. Map of existing and proposed hydropower projects on the middle Snake River in Idaho.

American Falls Dam. Dam construction adversely affects aquatic species through direct habitat modification and the ability of the Snake River to assimilate point and nonpoint source pollution. Further hydroelectric development along the Snake River would inundate existing snail habitats through impoundment; reduce critical shallow shoreline habitats in tailwater areas due to water fluctuations; elevate water temperatures; reduce dissolved oxygen levels in impounded reaches; and further fragment remaining mainstem populations or colonies of the listed snails.

Load-following also threatens native aquatic species habitat. Load-following is a frequent and sporadic practice that results in dewatering aquatic habitats in shallow shoreline areas. With the exception of the Banbury Springs lanx and possibly the Snake River physa, these daily water fluctuations prevent federally listed species and species of concern from occupying the most favorable habitats. The quality of water in these habitats has a direct effect on the survival of native aquatic species. Water temperature, velocity, dissolved oxygen concentrations and substrate type are all critical components of water quality that affect the survival of the 5 listed aquatic snails. These species require cold, clean, well-oxygenated and rapidly flowing waters. They are intolerant of pollution and factors that cause oxygen depletion, siltation, or warming of their environment.

Recovery of the listed species will require restoration of their habitat, and will entail restoration of the water quality of the middle Snake River to a level that supports and maintains a diverse and sustainable aquatic ecosystem. In particular, reduction of nutrient and sediment loading to the river and restoration of riverine conditions are needed to recover the listed species.

Any factor that leads to a deterioration in water quality would likely extirpate these taxa. For example, the Banbury Springs lanx lacks lungs or gills and respires through unusually heavy, vascularized mantles. This species cannot withstand even temporary episodes of poor water quality conditions. Because of stringent oxygen requirements, any factor that reduces dissolved oxygen concentrations for even a few days would very likely prove fatal to most or all of the listed snails.

Factors that further degrade water quality include reduction in flow rate, warming due to impoundment, and increases in the concentration of nutrients, sediment and other pollutants reaching the river. The Snake River is affected by runoff from feedlots and dairies, hatchery and municipal sewage effluent, and other point and nonpoint discharges. During the irrigation season, 13 perennial streams and more than 50 agricultural surface drains contribute irrigation tailwater to the Snake River [Idaho Department of Health and Welfare (IDHW) 1991]. In addition, commercial, State and Federal fish culture facilities discharge wastewater into the Snake River and its tributaries. These factors coupled with periodic, drought-induced low flows, have contributed to reduced dissolved oxygen levels and increased plant growth and a general decline of cold-water free-flowing river species of the Snake River. Water quality in the alcove springs and tributary spring streams in the Hagerman Valley area have also been affected, though not as severely as the mainstem Snake River. The Hagerman area receives massive cold-water recharge from the Snake River Plain aquifer. However, several of these springs and spring tributaries have been diverted for hatchery use, which reduces or eliminates clean water recharge and contributes flows enriched with nutrients to the Snake River. At TNC's Preserve, colonies of Utah valvata and Bliss Rapids snail have recently declined or been eliminated at several sites. This decline is due to decreases in water quality primarily from agriculture and aquaculture wastewater originating outside of and flowing into the Preserve (Frest and Johannes 1992).

Another threat to the listed species is the presence of the New Zealand mudsnail (Potamopyrgus antipodarum) in the middle Snake River. The widely distributed and adaptable mudsnail is experiencing explosive growth in the Snake River and shows a wide range of tolerance for water fluctuations, velocity, temperature and turbidity. The species seems to prefer warmer polluted waters over pristine cold spring environments. Based on recent surveys, the mudsnail is not abundant in habitats preferred by Banbury Springs lanx, Bliss Rapids snail, or the Utah valvata. However, the species does compete directly for habitats of the Snake River physa and Idaho springsnail in the mainstem Snake River.

D. CONSERVATION MEASURES

At present, there are several State and Federal programs and conservation efforts that may help achieve recovery objectives for the Snake River aquatic species:

1. Federal Clean Water Act (CWA)

Several provisions within the CWA regulate activities that affect the Snake River aquatic species and their habitats:

Sections 302/303 These provisions provide for the establishment of water quality standards and the setting of effluent limits for point source discharges. Section 302 requires the establishment of "water quality-based" standards for situations where technology-based standards are not adequate to protect designated uses.

Section 303 specifies that states are required to establish water quality standards. Standards identify designated uses of the water and establish the biological/chemical criteria necessary to protect those uses. The designated uses of the middle Snake River include cold-water biota, salmonid spawning, domestic and agricultural water supplies, secondary and primary contact recreation, and special resource water.

Section 303 also requires states to identify those waters which do not meet state water quality standards. These waters, described as "water quality limited," are subject to water quality management planning and the development of total maximum daily loads (TMDLs). In 1990, the Division of Environmental Quality (DEQ) determined that the middle Snake River from Shoshone Falls to King Hill was water quality limited and that the designated uses of the water were not supported. As a result of the water quality limited designation, DEQ is developing a Nutrient Management Plan (NMP) for the middle Snake River under the State of Idaho (State) Nutrient Management Act. The NMP is intended to meet the requirements of the CWA and serve in place of a TMDL, and would specify allowable nutrient levels.

Section 319 This section of the CWA provides for states to set up management programs specifically dealing with nonpoint sources of water pollution. In Idaho, the Department of Lands is the authorized agency for mining, forestry, and agriculture programs. Best management practices (BMPs) have been developed for each industry to control water pollution from nonpoint sources. Of those industries, agriculture is the only significant industry affecting water quality in the Snake River [see Agricultural Pollution Abatement Plan (#3 below) for further discussion].

Section 401 DEQ administers Idaho's 401 Certification Program. Under section 401, projects that involve discharge into state navigable waters must obtain water quality certification. In certifying discharges, the State verifies that the proposed activity is in compliance with State water quality standards. For example, the State must provide water quality certification on Federal Energy Regulatory Commission (FERC) licenses for hydropower projects, and on CWA section 404 permits.

Water quality standards for the middle Snake River are based on cold-water biota. The cold-water biota standard is characterized by the following: dissolved oxygen concentrations exceeding 6 milligrams/liter (mg/l) at all times, water temperatures of 22°C (71.6°F) or less with maximum daily averages of no greater than 19°C (66.2°F), specific ammonia concentrations, and specific requirements for salmonid spawning.

Section 404 The CWA provides for placement of dredged or fill material into waters of the United States (U.S.), including wetlands, only when permitted by the U. S. Army Corps of Engineers (COE). The COE bases permit decisions on application of the 404(b)(1) guidelines developed by the Environmental Protection Agency (EPA). These require avoidance, minimization, and compensation for adverse impacts to aquatic resources associated with discharge of dredge or fill material. Activities regulated under section 404 include placement of material in rivers and adjacent wetlands associated with the construction of dams, bridges, and roads.

National Pollutant Discharge Elimination System (NPDES) The NPDES program is covered under the CWA and is administered in Idaho by the EPA. The NPDES program requires permits for the discharge of pollutants from any point source into waters of the U.S. Examples of such point source discharges in the middle Snake River are: concentrated animal feeding operations, concentrated aquatic animal production facilities, discharges from industrial facilities, discharges of storm water, and discharges from sewage treatment facilities. Currently, the Snake River receives effluent from over 130 permitted discharges.

2. Salmon Flow Augmentation and Water Supplementation Measures

Recent efforts to aid Snake and Columbia River salmon recovery downstream of Hell's Canyon may complement Snake River aquatic species recovery. These efforts began in 1988 with the Joint Agreement Regarding Fish and Wildlife Studies (Agreement) pursuant to the enactment of Public Law (P.L.) 100-216. Parties to the Agreement are the Department of the Interior, National Marine Fisheries Service (NMFS), and IPC. The objectives of the Agreement are to identify and evaluate potential water supplies to augment flows in the Snake River for improved juvenile salmon migration. The study, commissioned by NMFS, estimated that up to 2,467 million m^3 [2.0 million acre-feet (ac-ft)] of storage could be made available for salmon migration flows from the upper Snake River without adversely impacting other water uses in Idaho (Hydrosphere 1990). The Bureau of Reclamation (BR) however, has not concurred with the estimates of the Hydrosphere report (BR in litt. 1994).

A second avenue of obtaining additional water to aid juvenile salmon migration was instituted in 1991 when Bonneville Power Administration (BPA) contributed money for water rental from Idaho Water Banks. Water banks are authorized by State law to market water held in storage at BR projects for other beneficial uses outside of the irrigation district that holds the storage rights. Since the water bank in the upper Snake River (District 01) was established in 1979, there have been an average of 237 million m^3 (192,000 ac-ft) of water placed annually in rental banks. The largest purchaser of the Water Bank water has been IPC, which on average buys 191 million m^3 (155,000 ac-ft) of stored water annually [Idaho Water Resources Board (IWRB) in litt. 1993]. In 1991, 122 million m^3 (99,000 ac-ft) was purchased from the Upper Snake Rental Pool. Part of this water was released in July and August, and the remainder was delivered down the Snake River past Milner Dam from December to February, 1992. In the spring and summer of 1992, no water was available for salmon flow augmentation from the upper Snake River because of persistent drought conditions.

The third opportunity to provide additional water for salmon flows stems from the 1993 biological opinion issued by NMFS on the operation of the Federal Columbia River Power System and its effects on listed salmon populations. In order to meet flow targets at Lower Granite Dam on the Snake River and McNary Dam on the Columbia River, BR agreed to release up to 539 million m^3 (437,000 ac-ft) of Snake River basin storage water. This translates roughly into a 42.5 cm/s [1,500 cubic feet/second (cfs)] release during July and August, and an additional 150 million m^3 (120,000 ac-ft) delivered to Brownlee Reservoir in the fall/winter period to refill releases made in September (BR 1993). According to BR (1994), the biological opinion issued by NMFS for the 1994-1998 operations of the Federal Columbia River Power System required that 650 million m^3 (527,000 ac-ft) of storage be secured in 1994 by BR and BPA for salmon flow augmentation from the Snake River basin. This amount will be increased each year until a total of 1,143 million m^3 (927,000 ac-ft) is permanently secured by January 31, 1999, for salmon flow augmentation from the Snake River basin (BR in litt. 1994).

The fourth planning effort to provide flows for salmon migration in the Snake River is known as the New Storage Appraisal Study. This study was requested by the Northwest Power Planning Council (Council) in its latest round of amendments to its Fish and Wildlife Program. The BR and the Service are considering water storage sites in various parts of the Snake River basin including tributaries upstream of American Falls Reservoir for potential use in salmon restoration. A final report was completed in January 1994. Regional interests are currently evaluating the results.

3. Agricultural Pollution Abatement Plan

The Idaho Agricultural Pollution Abatement Plan (Ag Plan) was originally developed by the State in 1983, under the authorities of section 208 of the CWA. The Ag Plan focuses on nonpoint source pollution which comes from many varied and diffuse sources and can be categorized by the general land disturbing activity causing the pollution. The Ag Plan directed the identification of priority stream segments for implementation of BMPs through a two-phase process including: 1) completing the identification of impaired waters, and 2) establishing a process for implementing site-specific BMPs. The Ag Plan further directed that each BMP must be effective in controlling nonpoint source pollution, economically feasible, and socially acceptable. BMPs satisfying these requirements were included in the List of Best Management Practices, maintained by the Natural Resources Conservation Service (NRCS). The Ag Plan is revised on a periodic basis and is used to update the lists of Priority Stream Segments and BMPs.

Section 319 of the CWA, as amended 1987, placed additional emphasis on the control of nonpoint source pollution. As a result of enactment of this section, the State developed the Idaho Nonpoint Source Management Program [Idaho Department of Health and Welfare (IDHW) 1989]. This Program identified a number of impacts resulting from agricultural uses which were not adequately addressed in the original Ag Plan (IDHW 1989).

Based on this information and recommendations from the Agricultural Water Quality Advisory Committee (AWQAC), the State revised the Ag Plan in 1993. Changes to the Ag Plan included strengthening the agricultural water quality program by increasing emphasis on livestock grazing/riparian management, agri-chemical management, and non-permitted livestock confinement areas (IDHW 1993). Other areas to be further defined included clarification of BMPs, the need to conduct post-implementation monitoring to evaluate BMP effectiveness, the compatibility of the Ag Plan with the State Antidegradation Policy, the Idaho Ground Water Protection Act, EPA's policy on agricultural chemicals and ground water quality, and others (IDHW 1993). The Ag Plan will be reviewed on a 2-year basis and amended as necessary.

4. IPC Relicensing Studies

The IPC has seven hydroelectric projects on the Snake River subject to FERC relicensing over the next 10 years. Five of these projects (Shoshone Falls, Bliss, Lower Salmon Falls, Upper Salmon Falls, and C. J. Strike) are located on the Snake River within the known range of the 5 threatened or endangered Snake River snails (Figure 7). In 1990, IPC initiated several terrestrial and aquatic studies to gather environmental information and describe the environmental baseline in the area as part of the relicensing process. This information will be essential, not only in evaluating how IPC hydroelectric operations impact fish and wildlife, but also in developing conservation measures to protect, mitigate, and enhance the Snake River's fish and wildlife resources during the relicensing process.

One example of a relicensing study is IPC's ongoing white sturgeon study developed in coordination with the Service and IDFG. The sturgeon studies are part of IPC's efforts to better define how future project operations can meet State and Federal agency resource goals and management objectives. Sturgeon studies are directed primarily toward determining the population status and habitat use by juvenile and adult white sturgeon in the Snake River and monitoring reproductive success in the serially landlocked sturgeon populations.

5. Snake River Adjudication

Water rights in the Snake River basin are subject to the Snake River Basin Adjudication process, i.e. water rights are assigned a priority date according to the date the use was initiated. The policy of the Idaho Department of Water Resources (IDWR) states that the needs of fish and wildlife resources will be given equal consideration in any project or program designed to promote conservation, development and optimum use of the state's water resources (IWRB 1992). Additionally, "beneficial use" includes nonconsumptive as well as consumptive uses (IWRB 1992).

As a result of the adjudication process, the IDWR is required to regulate ground water diversions, as well as surface water, in the Snake River Plain aquifer to sustain springflows which originate from the aquifer. Depending on the extent of regulations and the response of the springs, springflows may be sustained at current or higher levels.

6. National Water Quality Assessment (NWQA) Monitoring Program

In 1991, the U.S. Geological Service (USGS) implemented the NWQA program. The goals of this program are to describe the status and trends in the quality of large, representative sections of the Nation's surface and ground water resources and to provide a sound, scientific understanding of the primary natural and human factors which affect the quality of these resources. In meeting these goals, the program will produce water quality information that will be useful to policy makers and managers at the national, state, and local levels.

A major component of the program are the 60 study-unit investigations, which are based on hydrologic units that include principal river and aquifer systems throughout the U.S. In 1991, the upper Snake River Basin was among the first 20 NWQA units selected for study under the full-scale implementation plan. These study-unit investigations are scheduled to follow a 10-year cycle of high and low intensity monitoring.

The 92,722 km^2 (35,800 mi^2) upper Snake River Basin study unit extends from its headwaters in Yellowstone National Park in northwestern Wyoming to King Hill in south-central Idaho. Specific surface water quality issues include elevated concentrations of sediments and nutrients, habitat degradation from sedimentation and hydrologic modification, and the occurrence of low dissolved oxygen and elevated temperature in surface water associated with agriculture, grazing, and aquaculture. Ground water issues such as contamination by nutrients and pesticides are frequently associated with agricultural activities in intensively irrigated areas. Additionally, nutrient contamination from recreational activities in the upper part of the study unit may affect both surface and ground water resources.

7. Mid-Snake River Ecosystem Studies

EPA, in cooperation with DEQ and local agencies, is overseeing ecosystem studies in the Snake River between King Hill and Milner Dam. These studies are part of a long-term monitoring program to assess the effects of nonpoint and point source pollutants on water quality. This information will be incorporated into the NMP being developed by DEQ under state authorities (see CWA authorities (#1) above).

The Snake River Ecosystem studies include monitoring by DEQ, University of Idaho (Moscow), Idaho State University (ISU) (Pocatello), and the Idaho Water Resources Research Institute (IWRRI) of water quality at selected tributaries, irrigation return flows and aquaculture outflows. These studies focus on sedimentation and the biological community of the middle Snake River. Data provided by these studies will be incorporated into an EPA ecosystem risk assessment model that describes existing nutrient and plant community dynamics. Additionally, the Middle Snake River Study Group, comprised of governmental and public representatives from Lincoln, Jerome and Gooding counties, has developed the draft Coordinated Water Resource Management Plan that recommends changes in state and local laws, ordinances, and regulations to address water quality problems in the Snake River within the 3 county area.

8. Ground Water Recharge Districts

Section 42-234 of Idaho Code authorizes the creation of ground water recharge districts. Changes to state water law enacted in 1994 allow any entity, not just recharge districts, to appropriate water for recharge projects. According to the IDWR, water rights permits have been approved authorizing diversions from the Snake River, Big Wood River and Little Wood River for ground water recharge. Surface water has been diverted and applied to several basalt fields where the water sinks rapidly to recharge the aquifer. Recharge diversions began in 1986; however, during subsequent drought years no water was available for recharge. During the spring runoff of 1993, almost 7 million m^3 (5,567 ac-ft) of water were diverted from the Little Wood River and 10 million m^3 (8,239 ac-ft) were diverted from the Snake River for ground water recharge under this program. In addition, the Southwest Irrigation District, in cooperation with BR and USGS, has proposed groundwater recharge projects under the High Plains State Groundwater Demonstration Act of 1983 (P.L. 98-434). The project allows for the development of seven recharge sites in the Oakley Fan area of the Snake River Plain (BR 1993).

9. "Partners for Wildlife" Private Lands Program

Partners for Wildlife is a Service program for preserving and restoring habitat in partnership with private landowners. The primary goal is to restore biological diversity on private lands with an emphasis on wetlands. The criteria for selecting projects to fund include those that benefit multiple resources (such as multiple species groups), those that benefit multiple habitat functions (such as filtering pollutants and providing wildlife habitat), those with a long-term agreement (minimum is 10 years), and those with a high degree of landowner participation and cost-sharing by other groups (cost effectiveness).

Examples where the Service is participating with private landowners to improve snail habitat in the Snake River include a constructed wetland system on an agricultural field now owned by TNC at the Preserve. The experimental system is designed to filter sediments and agri-chemicals from irrigation return flows before they enter the Snake River at the Preserve. Wetland habitat for wildlife will also be provided.

A second Partners for Wildlife project has been designed to divert irrigation return flows and create wetland habitat to filter the water before it enters the Snake River. The landowner hopes to restore the original habitat values of the land and to manage the area for wildlife conservation.

10. IDWR Authorities

The IDWR manages several programs that affect the Snake River ecosystem (IDWR in litt. 1993). These programs include:

Moratorium Preventing Further Appropriation The director of the IDWR issued a moratorium order in May 1992 (recently amended to extend through December 1997), preventing further consumptive appropriation of water from springflows, several of which are inhabited by listed snails, or from ground water which supports spring habitats. However, the moratorium does not apply to any application for domestic purposes, to applications for ground water as a supplemental water supply for existing surface water rights or for permits to deepen existing wells having valid rights.

Stream Channel Alteration Permits Title 42, Chapter 38, of the Idaho Code grants IDWR authority to regulate stream channel alterations below the mean high water mark of streams. In the Snake River reaches containing listed snail habitats, all proposed stream channel alteration projects will be preceded by an assessment of project effects on the listed snails.

Middle Snake River Comprehensive Plan This component of the Idaho State Water Plan dealing specifically with the middle Snake River was adopted by the IWRB in 1993 and approved by the Idaho legislature in 1994. The plan protects selected reaches of the middle Snake River by designating them as either "Recreational" or "Natural" rivers. These designations prohibit construction or expansion of dams or impoundments.

Minimum Stream Flow Program Idaho Code, Title 42, Chapter 15 provides the authority for the IWRB to appropriate water for minimum streamflows, also called instream flows. A minimum streamflow is one in which water is not diverted for consumptive use, but remains in a specified reach of river or lake to provide for fish and wildlife habitat, aquatic life, recreation and water quality. Minimum flows are valid water rights which the IWRB holds in trust for the people of Idaho. See Appendix E for a list of instream flow rights currently held by the State in the middle Snake River.

Snake River Plain Aquifer Comprehensive Plan As a supplement to the State Water Plan and the Middle Snake River Comprehensive Plan, the IWRB is developing a Snake River Plain Aquifer Comprehensive Plan. The plan is due for draft review in 1995 and will deal mainly with water quantity in the aquifer.

11. Agricultural Conservation Program (ACP)

The ACP program, administered by the Farm Services Agency (FSA), offers cost-share assistance to landowners for conservation of soil and water resources. Technical assistance is typically provided by the NRCS through local Soil and Water Conservation Districts (SWCD). Practices installed under this program can include construction and enhancement of wetlands for water quality, enhancing irrigation water efficiency and reduction of soil, pesticide and nutrient delivery to the Snake River.

12. NRCS Small Watershed and Resource Conservation and Development (RC&D) Program

The Small Watershed and RC&D programs provide cost-share assistance to local individuals on a group or watershed basis for the conservation of soil, water, plant and animal resources. The program is administered through NRCS, working with local SWCD and RC&D committees. These programs are usually sponsored by local districts, assuring local input into the projects. Currently there are several Small Watershed and RC&D projects being planned or implemented in the middle Snake River area.

E. STRATEGY FOR RECOVERY

Recovery of the 5 listed snails, and ultimately the middle Snake River ecosystem, is contingent upon conserving and restoring essential mainstem Snake River and cold-water spring tributary habitats. This Plan extends from C.J. Strike Reservoir upstream to American Falls Dam (Figure 1) and acknowledges that allocated ground and surface waters can continue to be managed for other beneficial uses. Implementation or scheduling of tasks is based on a priority system. Priority 1 tasks are those actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. Priority 2 tasks are those actions that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.

Actions (or tasks) that have the highest priority for implementation include:

Secure, restore, and maintain essential aquatic habitats (Priority 1)

Recovery will require that remaining free-flowing mainstem habitats between C.J. Strike Reservoir and American Falls Dam are protected and preserved, and existing cold-water spring habitats are protected from further development or habitat degradation. Conservation measures available to achieve this protection may include: using existing State and Federal legislative authorities (Middle Snake River Comprehensive Plan, Endangered Species Act (Act), Wild and Scenic River Act, and Fish and Wildlife Coordination Act) to protect and preserve remaining free-flowing habitats; flow-augmentation to maintain year-round flows behind Milner Dam; development of habitat management and conservation plans to protect and enhance cold-water spring complexes on State, Federal and private lands; development of ground water management plan(s) to stabilize the water levels (= spring discharge) of the Snake River Plain aquifer; improvements in water quality through existing State and Federal initiatives; and evaluating programs to control or minimize the effects of non-native species.

Rehabilitate, restore and maintain watershed conditions (Priority 1)

Watershed conditions greatly influence water quality, water quantity, and timing of flows in aquatic habitats along the Snake River. The Service will encourage the further development and implementation of conservation measures to improve the condition of riparian, wetland, and upland watershed components that affect water quality and aquatic habitats in the middle Snake River ecosystem.

Monitor native fauna populations and habitat (Priority 1 and 2)

Concurrent with efforts to protect essential Snake River aquatic habitats, further research on Snake River indicator species (including the 5 listed species) is necessary to refine life history and habitat requirements. This information will be essential to fully understand the population dynamics of these species and allow resource managers to evaluate the effectiveness of conservation measures in meeting recovery goals.

Update and revise recovery plan criteria and objectives (Priority 2)

The Plan should be updated and revised as additional information becomes available, recovery tasks are accomplished, or as environmental conditions change.

PART II - RECOVERY

`Ecosystem management integrates scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystem integrity over the long-term.' -R. Edward Grumbine, 1994

A. RECOVERY OBJECTIVES

The short-term recovery objectives of this Plan are to protect known live colonies of the federally listed snails by eliminating or reducing known threats (see tasks # 1-126,211-312, 321 and 41). The long-term objectives are to restore viable, self-reproducing colonies of the 5 listed snails within specific geographic ranges (referenced in the Recovery Criteria below) to the point that they are delisted. As new information is collected, and Priority 1 tasks are accomplished, long-term recovery criteria and additional conservation measures will be further refined to reverse declining habitat trends and restore the middle Snake River ecosystem. Restoring the middle Snake River ecosystem will also protect 4 aquatic species considered by the Service to be Species of Concern, so that future listing may be unnecessary. The Service also believes components of this Plan will be complimentary to conservation measures designed by NMFS to meet Snake River chinook and sockeye salmon recovery objectives.

B. RECOVERY CRITERIA

The 5 federally listed snails may be reclassified or recovered by implementing various conservation measures that preserve and restore mainstem Snake River and tributary cold-water spring habitats. These habitats are essential to their survival within the specified recovery areas described below. The Plan includes short-term recovery goals that will provide specific downlisting/delisting criteria for the listed species. Recovery will be based on detection of increasing, self-reproducing colonies at pre-selected monitoring sites within each species recovery area for a 5-year period. Monitoring sites will be selected in areas of known live snail collections from the past 15 years and will generally represent the outer most boundaries of the recovery area for each species. Standards for habitat conditions will be based on State water quality standards for cold-water biota including annual water temperatures that average below 18°C; dissolved oxygen concentrations greater than 6 parts per million; and pH levels that are within the range of 6.5 to 9.5 mg/l.

- o **Idaho springsnail**:

  - The recovery area (see Figure 2) includes the mainstem Snake River between rkm 834 to 890 (rm 518 to 553).
  - Suitable habitats will include mud or sand associated with gravel-to-boulder size substrate.
  - Idaho springsnail monitoring sites will be established in the mainstem Snake River: 1) at Bancroft Springs near rkm 890 (rm 553), 2) at the confluence of Clover Creek near rkm 881 (rm 547), and 3) near Slick Bridge between rkm 859 and 862 (rm 534 and 536).

- o **Utah valvata snail**:

  - The recovery area (see Figure 3), includes the mainstem Snake River and tributary cold-water spring complexes between rkm 932 to 1,142 (rm 572 to 709).
  - Suitable habitats will include well-oxygenated mud or sand substrates.
  - Utah valvata snail monitoring sites will be established in the mainstem Snake River: 1) below American Falls Dam (near the old Eagle Rock damsite) at rkm 1,141 (rm 709), 2) downstream of Minidoka Dam near rkm 1,085 (rm 674), and 3) upstream of Empire Rapids (north of the city of Buhl) near rkm 957 (rm 595); and in cold-water tributaries at: 1) Box Canyon Springs at rkm 947 (rm 588), 2) Thousand Springs at rkm 941 (rm 584), and 3) along the east shoreline of the Snake River, at the Hagerman Fossil Beds Monument rkm 611 (rm 572).

- o **Snake River physa**:

  - The recovery area (see Figure 4) includes the mainstem Snake River between rkm 890 to 1086 (rm 553 to 675).
  - Suitable habitats will include rock and boulder substrate in deep water at the margins of rapids.
  - Snake River physa monitoring sites will be established in the mainstem Snake River: 1) downstream of Minidoka Dam near rkm 1,085 (rm 674), 2) downstream of the confluence of the Malad River and the Snake River near rkm 917 (rm 570), and 3) at Bancroft Springs near rkm 890 (rm 553).

- o **Bliss Rapids snail**:

  - The recovery area (see Figure 5) includes the mainstem Snake River and tributary cold-water spring complexes between rkm 880 to 942 (rm 547 to 585).
  - Suitable habitats will include cobble-boulder substrates.
  - Bliss Rapids snail monitoring sites will be established in the mainstem Snake River: 1) at the confluence of Clover Creek and the Snake River near rkm 881 (rm 547), 2) near the Bliss Bridge at rkm 604 (rm 565), and 3) at Bancroft Springs near rkm 890 (rm 553); and at cold-water spring tributaries: 1) at Banbury Springs, rkm 948 (rm 589), 2) at Box Canyon Springs rkm 947 (rm 588), and 3) at Thousand Springs rkm 941 (rm 584).

- o **Banbury Springs lanx**:

  - The recovery areas (see Figure 6) and monitoring sites for the Banbury Springs lanx are tributary cold-water spring complexes to the Snake River between rkm 941.5 to 948.8 (rm 584.8 to 589.3): 1) at Banbury Springs rkm 948 (rm 589), 2) at Box Canyon Springs rkm 947 (rm 588), and 3) at Thousand Springs rkm 941 (rm 584).
  - Suitable habitats will include well-oxygenated, clear, cold [15-16°C (59-61°F)] water on boulder or cobble substrate.

Actions Needed to Initiate Recovery:

1. Ensure State water quality standards for cold-water biota and habitat conditions so that viable, self-reproducing snail colonies are established in free-flowing mainstem and cold-water spring habitats within specified geographic ranges, or recovery areas, for each of the 5 species. Snails detected at the sites selected for monitoring will be surveyed on an annual basis to determine population stability and persistence, and verify presence of all life history stages for a minimum of 5 years.

2. Develop and implement habitat management plans that include conservation measures to protect cold-water spring habitats occupied by Banbury Springs lanx, Bliss Rapids snail, and Utah valvata snail from further habitat degradation (i.e. diversions, pollution, development) as described in Action #1.

3. Stabilize the Snake River Plain aquifer to protect discharge at levels necessary to conserve occupied cold-water spring habitats.

4. Evaluate the effects of non-native flora and fauna on listed species in the Snake River from C.J. Strike Dam to American Falls Dam.

Additionally, recovery of the Snake River aquatic species will require improved interagency coordination between government and non-government organizations. In this Plan, the Service acknowledges the various programs underway at the local, State and Federal level to address water quality and watershed problems affecting the Snake River basin. Improved interagency coordination will ensure that these and future programs are compatible with recovery objectives of the Snake River aquatic species.

As recovery measures are accomplished and/or as additional information becomes available, the recovery plan will be updated biennially and revised within 5 years, if necessary (see task # 71). Results of ongoing research and monitoring programs will also guide the development and implementation of additional future conservation measures.

C. NARRATIVE

Figure 8 outlines the Snake River aquatic species recovery measures. Tasks # 1-126, 211-312, 321and 41 are short-term recovery measures the Service believes are essential to prevent extinction of the listed snails and halt further declines in their distribution and habitat quality.

1 Secure, restore, and maintain essential aquatic habitats between C.J. Strike Reservoir and American Falls Dam to prevent extinction.

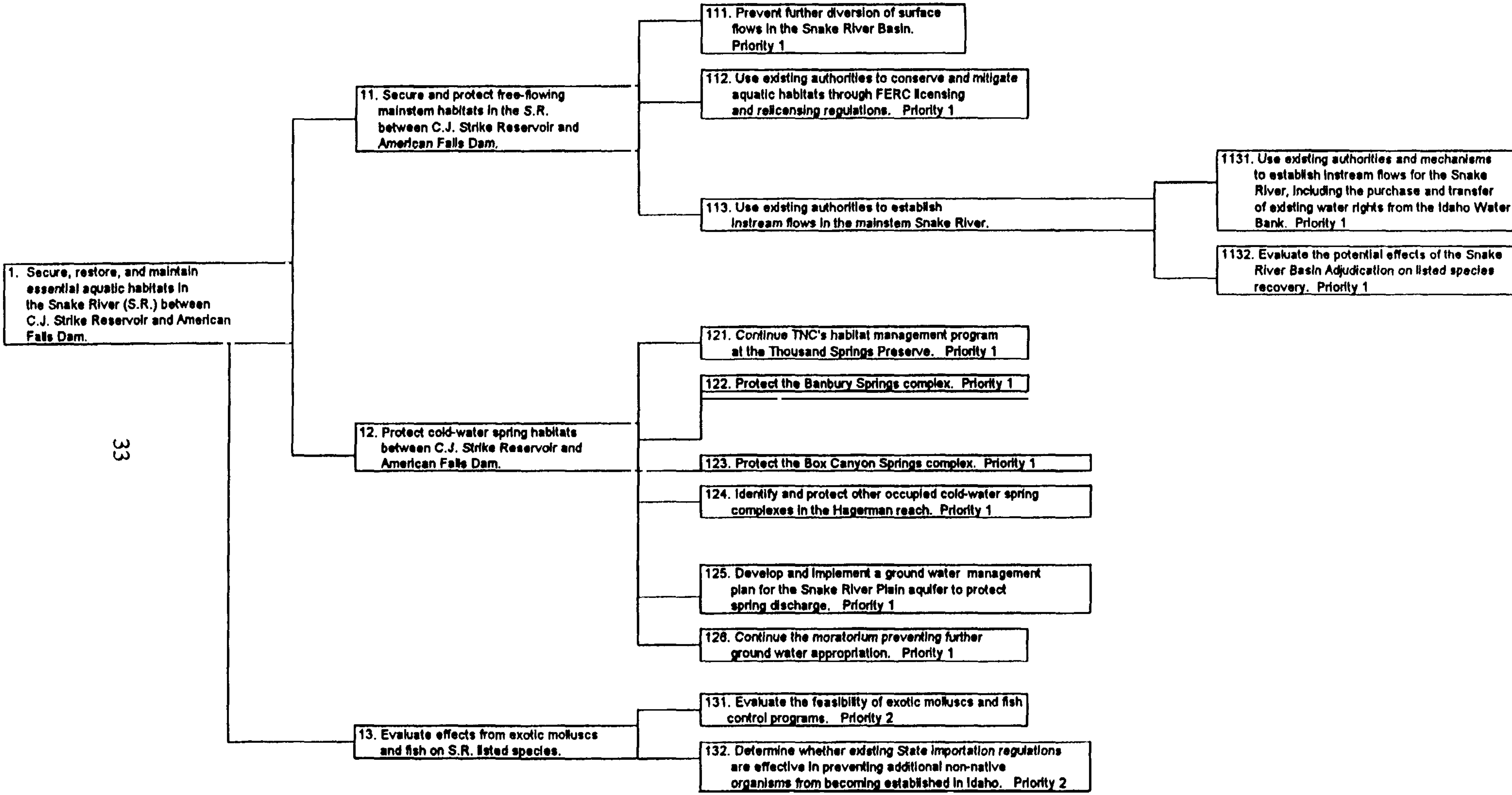
Initial recovery efforts will require that appropriate water quality and flow volume standards are developed, achieved, and maintained for the Snake River. This will allow for viable self-reproducing snail colonies in suitable mainstem habitats between C.J. Strike Reservoir and American Falls Dam. Because the Bliss Rapids snail may exist above American Falls (see task # 313), the Service may include additional reaches of the Snake River upstream of American Falls Dam as part of the recovery area in future Plan revisions (see task #71). Additionally, all cold-water spring streams containing suitable habitat for the federally listed and species of concern molluscs and fish must be permanently protected from further habitat degradation, reductions in spring discharge, and vandalism.

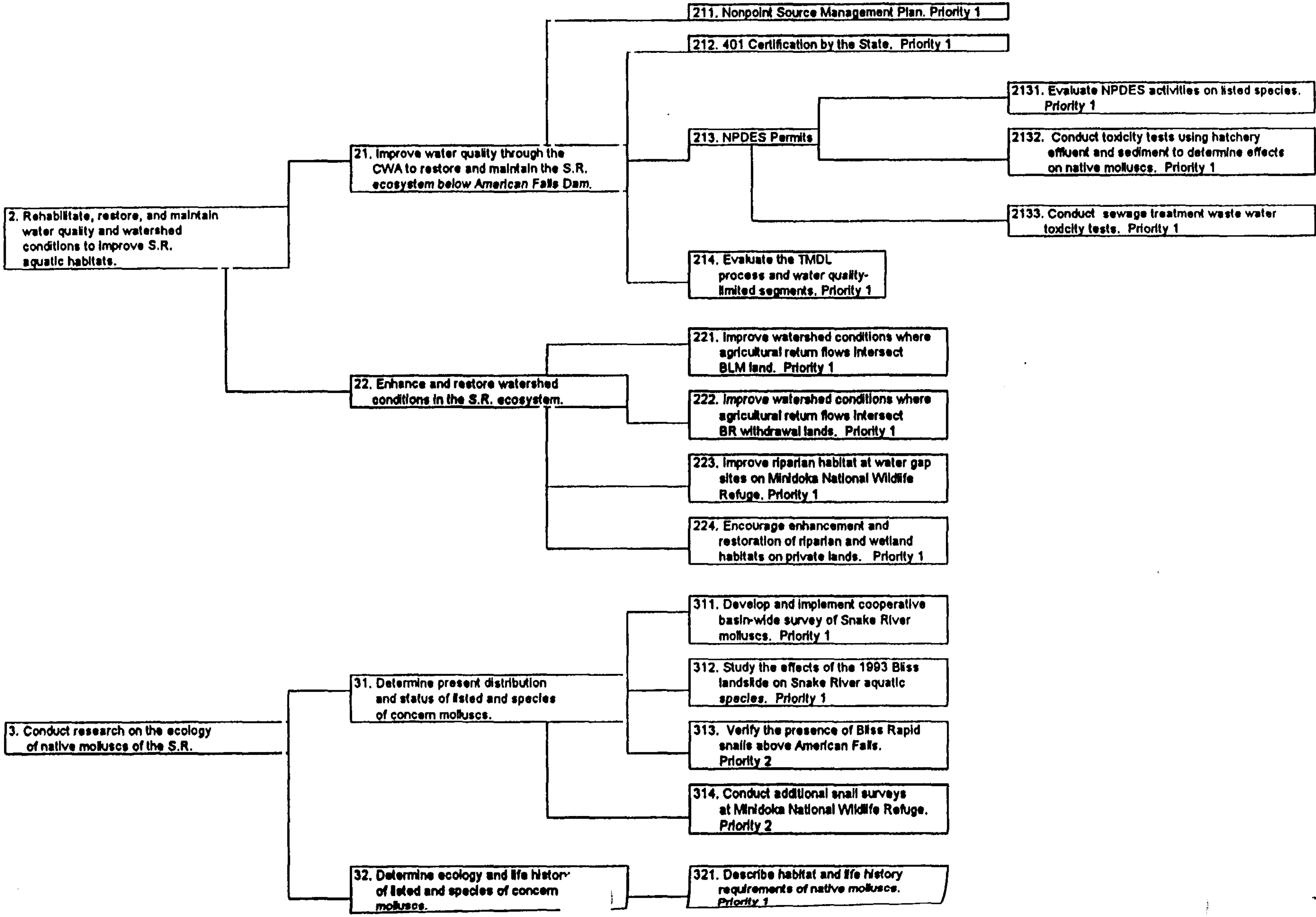
11 Secure and protect free-flowing mainstem habitats between C.J. Strike Reservoir and American Falls Dam.

Hydropower development resulting in habitat loss have been identified as a major factor leading to the listing of these species (Service 1992). Much of the original free-flowing habitat has been lost or inundated due to direct impacts from dams, reservoirs, and diversions. For example, within the 350 rkm (219 rm) reach between C.J. Strike Reservoir and American Falls Dam, only 47% (166 rkm, 104 rm) is still considered free-flowing, with a natural complement of rapid/pool habitats.

In addition to the already licensed, but unconstructed, Auger Falls Project, there are 6 active proposals to construct new hydropower projects on the mainstem Snake River downstream of American Falls. All are associated with free-flowing rapids areas. The Service will continue to utilize existing legislation and regulations (the Act, Fish and Wildlife Coordination Act, Federal Power Act, and Middle Snake

Figure 8. Flow chart summarizing Snake River aquatic species recovery measures.
Priority 1 - An action that must be taken to prevent extinction or to prevent the threatened and endangered species from declining irreversibly.
Priority 2 - An action that must be taken to prevent a significant decline in the species population/habitat quality or some other significant negative impact short of extinction.
Priority 3 - All other actions necessary to meet the recovery objectives.

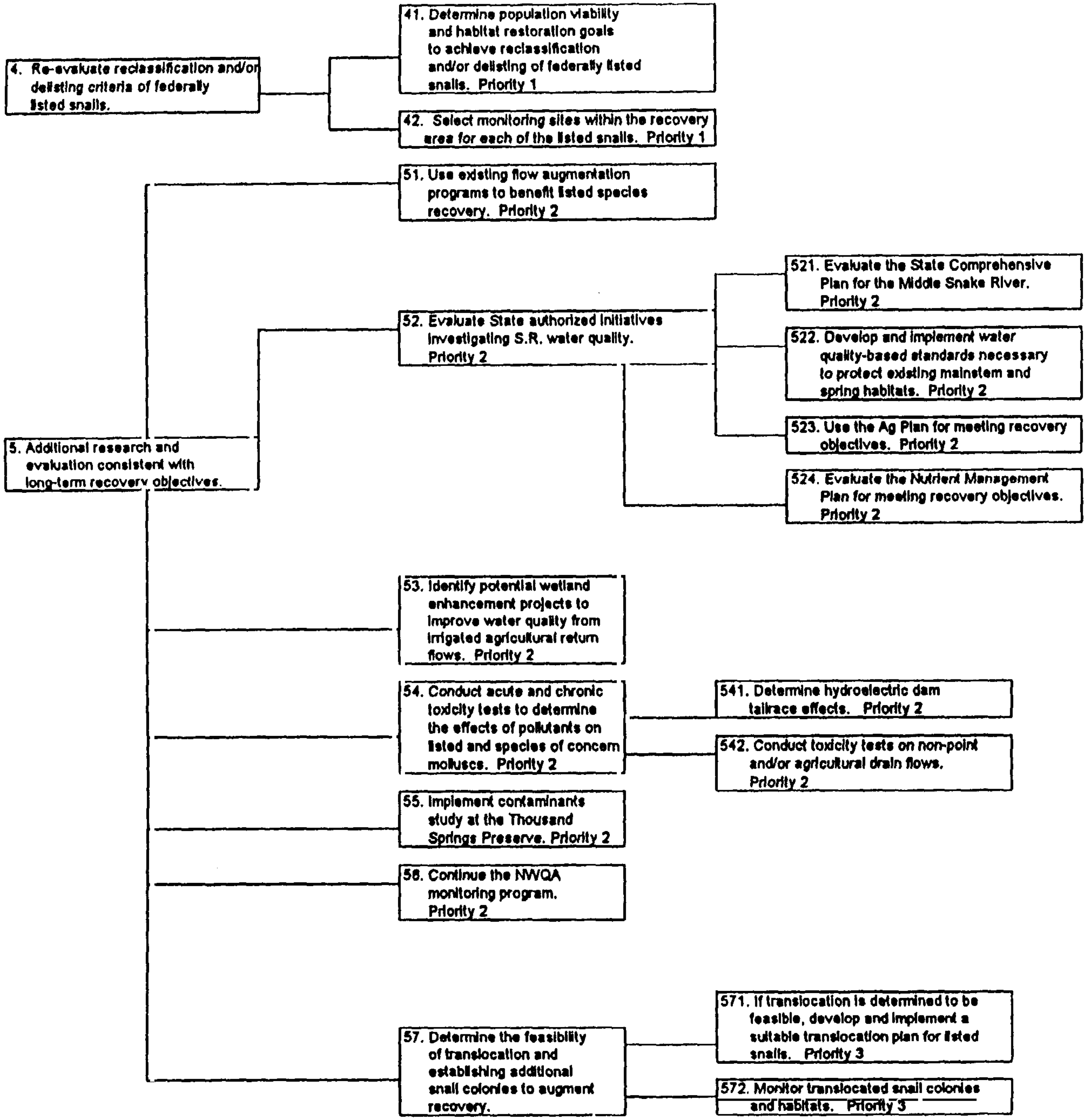



2. Rehabilitate, restore, and maintain water quality and watershed conditions to improve S.R. aquatic habitats.
21. Improve water quality through the CWA to restore and maintain the S.R. ecosystem below American Falls Dam.
211. Nonpoint Source Management Plan. Priority 1
212. 401 Certification by the State. Priority 1
213. NPDES Permits
2131. Evaluate NPDES activities on listed species. Priority 1
2132. Conduct toxicity tests using hatchery effluent and sediment to determine effects on native molluscs. Priority 1
2133. Conduct sewage treatment waste water toxicity tests. Priority 1
214. Evaluate the TMDL process and water quality-limited segments. Priority 1
22. Enhance and restore watershed conditions in the S.R. ecosystem.
221. Improve watershed conditions where agricultural return flows intersect BLM land. Priority 1
222. Improve watershed conditions where agricultural return flows intersect BR withdrawal lands. Priority 1
223. Improve riparian habitat at water gap sites on Minidoka National Wildlife Refuge. Priority 1
224. Encourage enhancement and restoration of riparian and wetland habitats on private lands. Priority 1
3. Conduct research on the ecology of native molluscs of the S.R.
31. Determine present distribution and status of listed and species of concern molluscs.
311. Develop and implement cooperative basin-wide survey of Snake River molluscs. Priority 1
312. Study the effects of the 1993 Bliss landslide on Snake River aquatic species. Priority 1
313. Verify the presence of Bliss Rapid snails above American Falls. Priority 2
314. Conduct additional snail surveys at Minidoka National Wildlife Refuge. Priority 2
32. Determine ecology and life history of listed and species of concern molluscs.
321. Describe habitat and life history requirements of native molluscs. Priority 1

molluscs.

Priority 1

- 6. Conduct research on the ecology of the native fishes of the S.R.
  - 61. Conduct research on the ecology of the S.R. white sturgeon. Priority 3
  - 62. Conduct research on the ecology of the Shoshone sculpin. Priority 3
  - 63. Secure remaining native cutthroat and redband trout habitats in the S.R. basin.
    - 631. Monitor the population and genetic status of the Vineyard Creek cutthroat trout. Priority 3
    - 632. Determine the status of remnant redband trout in Snake River tributaries. Priority 3
    - 633. Identify additional conservation measures to protect unique trout stocks between C.J. Strike Reservoir and American Falls Dam. Priority 3
- 7. Monitoring and recovery plan assessment.
  - 71. Biennially assess the overall success of the recovery program and revise the the recovery plan on a 5-year basis. Priority 2


4. Re-evaluate reclassification and/or delisting criteria of federally listed snails.
41. Determine population viability and habitat restoration goals to achieve reclassification and/or delisting of federally listed snails. Priority 1
42. Select monitoring sites within the recovery area for each of the listed snails. Priority 1
5. Additional research and evaluation consistent with long-term recovery objectives.
51. Use existing flow augmentation programs to benefit listed species recovery. Priority 2
52. Evaluate State authorized initiatives investigating S.R. water quality. Priority 2
521. Evaluate the State Comprehensive Plan for the Middle Snake River. Priority 2
522. Develop and implement water quality-based standards necessary to protect existing mainstem and spring habitats. Priority 2
523. Use the Ag Plan for meeting recovery objectives. Priority 2
524. Evaluate the Nutrient Management Plan for meeting recovery objectives. Priority 2
53. Identify potential wetland enhancement projects to improve water quality from irrigated agricultural return flows. Priority 2
54. Conduct acute and chronic toxicity tests to determine the effects of pollutants on listed and species of concern molluscs. Priority 2
541. Determine hydroelectric dam tailrace effects. Priority 2
542. Conduct toxicity tests on non-point and/or agricultural drain flows. Priority 2
55. Implement contaminants study at the Thousand Springs Preserve. Priority 2
56. Continue the NWQA monitoring program. Priority 2
57. Determine the feasibility of translocation and establishing additional snail colonies to augment recovery.
571. If translocation is determined to be feasible, develop and implement a suitable translocation plan for listed snails. Priority 3
572. Monitor translocated snail colonies and habitats. Priority 3

River Comprehensive Plan), in cooperation with FERC, COE and the State to protect and preserve these remaining free-flowing habitats in the near-term. Permanent or long-term protection of these free-flowing reaches will likely require Federal protection under the Wild and Scenic Rivers Act and, to a lesser extent, State designations (see Conservation Measure #10).

111 Prevent further diversion of surface flows in the Snake River basin.

Current State law (State Comprehensive Water Plan) allows flows in the Snake River to reach zero at Milner Dam (rkm 1,028, rm 639). Snake River surface flows may be affected in the future by the Agreement, which authorized research studies conducted between C.J. Strike and Brownlee Pool, pursuant to P. L. 100-216, and by the Snake River Basin Adjudication. The Service will likely oppose any additional surface flow appropriations from the Snake River that affect mainstem aquatic habitats.

112 Use existing authorities to conserve and mitigate for the loss of aquatic habitats through the FERC licensing and relicensing regulations.

Section 7(a) of the Act requires Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species. IPC has seven hydroelectric projects on the Snake River below American Falls Dam subject to FERC relicensing over the next 12 years. In addition to the section 7(a) consultation required for relicensing, the Service has also requested FERC to evaluate the effects of ongoing hydroelectric operations by IPC on the 5 listed Snake River snails. Mitigation efforts for relicensing should include restoration or protection of existing remaining spring and mainstem habitats in the Snake River. For example, the Thousand Springs hydroelectric facility near Hagerman should be considered in the overall mitigation planning for the loss of habitat due to hydroelectric development.

113 Use existing authorities to establish instream flows in the mainstem Snake River.

The IWRB can appropriate water for beneficial instream uses, subject to the approval of the State legislature (Idaho Code Chapter 15, Title 42). These instream flows, or minimum streamflows, are valid water rights the IWRB holds in trust. The IWRB also maintains the Idaho Water Bank, which provides for the sale or lease of water from rental pools. There are Federal reserved water rights in Idaho that must be identified and quantified, including Snake River instream flow. A list of the existing minimum streamflows for the recovery area is contained in Appendix E.

1131 Use existing authorities to establish instream flows for the Snake River, including the purchase and transfer of existing rights from the Idaho Water Bank.

The Service, through cooperation and discussions with the IWRB, BR and other appropriate State and local authorities, will seek additional opportunities to establish minimum Snake River instream flows that directly benefit the listed species within their specific recovery area.

1132 Evaluate the potential effects of the Snake River Basin Adjudication on listed species recovery.

Water rights in the Snake River basin are subject to the ongoing Snake River Basin Adjudication process. These water rights are assigned a priority according to the date the use was initiated. An evaluation of the potential effects to snail recovery should be conducted using the IDWR Director's Report of water rights analyzing existing ground water resources and uses in the Snake River area. The Service has filed a recommendation for maintaining Snake River instream flow levels that could result in a significant source of water.

12 Protect cold-water spring habitats between C.J. Strike Reservoir and American Falls Dam.

To promote recovery of cold-water spring biota within the Snake River ecosystem, existing cold-water spring habitats should be secured and protected from further development or habitat degradation. For example, the Banbury Springs lanx is known to occur only in three spring habitats at Banbury Springs, Box Canyon Springs and Thousand Springs between rkm 942 and 949 (rm 584.8 and 589.3). These and other cold-water spring complexes contain colonies of the threatened Bliss Rapids snails, endangered Utah valvata, and populations of the Shoshone sculpin, a species of concern. At present, only the lanx colonies at Thousand Springs Preserve and Banbury Springs are protected from habitat modification or water diversions.

Cold-water springs in the Snake River ecosystem are dependent on the stabilization and protection of the Snake River Plain aquifer. Section 7 and section 9 provisions of the Act can assist in protection of the 5 listed snails, but these programs alone cannot recover the species. To achieve recovery, the aquifer and spring discharges supplying the remaining spring habitats must be protected. The IDWR administers water rights and regulates water management in the Snake River area. By exercising their water management authority, IDWR can lawfully assist efforts to conserve the ground water resource essential to maintaining Snake River species spring habitats while still providing for other beneficial uses (see tasks # 125 & 126).

121 Continue TNC's habitat management program at the Thousand Springs Preserve.

The Preserve, owned and managed by TNC, includes several cold-water spring outflows. Many of these outflows provide essential habitats for the Utah valvata snail, Bliss Rapids snail, Banbury Springs lanx, and Shoshone sculpin. TNC has instituted a comprehensive program to restore native vegetation at the Preserve, and monitor water quality and flows at several of the Preserve's spring outflows and channels. In 1991, TNC funded a mollusc survey of the entire Preserve. The Service supports TNC initiatives at the Preserve and will seek additional opportunities to enhance aquatic habitats at the site.

Additionally, TNC entered into a cooperatively-funded effort with the Northside Canal Company, NRCS and the Service to construct a wetland complex to improve the water quality of agricultural return flows at the Preserve under the Partners for Wildlife program (see conservation measures #9). This demonstration project will be monitored and evaluated for its effectiveness at filtering out nutrients and other pollutants from return flows. This information will also be useful in implementing task # 224.

In summary, current TNC management direction should provide long-term protection of existing spring habitats from direct human impacts. However, TNC cannot directly control or curtail future habitat loss or modification due to further declines in spring discharges from the Snake River Plain aquifer. Any habitat management plan should include establishment of minimum spring flows through the State minimum streamflow program, administered by IWRB.

122 Protect the Banbury Springs complex.

The Banbury Springs complex is currently owned and managed by IPC. Any change in existing management or development of the area may adversely affect essential habitat for a colony of the Banbury Springs lanx and several colonies of Bliss Rapids snail.

1221 Develop and implement a habitat management plan for the Banbury Springs complex.

In cooperation with the Service, IPC should develop a Habitat Conservation Plan that provides long-term protection of spring and spring-stream habitats that comprise the Banbury Springs complex. Any habitat management plan should include establishment of minimum spring flows through the State minimum streamflow program, administered by IWRB.

123 Protect the Box Canyon Springs complex.

The Box Canyon Springs complex is partially owned by the Bureau of Land Management (BLM) and a private landholder. BLM has proposed designating a portion of Box Canyon Creek and adjacent upland habitats as an Area of Critical Environmental Concern (ACEC) in the draft Bennett Hills Resource Management Plan. The ACEC designation will protect both listed snails and Shoshone sculpin habitat at Box Canyon. Additionally, BLM is considering designating Box Canyon Creek as a Wild and Scenic River.

The Service opposes any further development or diversion of water at the Box Canyon Springs complex that may affect essential spring habitats, including the Sculpin Pool. The lower Box Canyon spring provides essential habitat for 3 of the federally listed snails and the Shoshone sculpin. The Service will use existing legislation and regulations, including section 7 and section 10 of the Act, to protect these species and their habitats in Box Canyon. Additionally, the Service will cooperate with private landholders to identify potential conflicts with future development proposals and promote the development of a Habitat Conservation Plan. Any Habitat Conservation Plan should include establishment of minimum spring flows through the State minimum streamflow program, administered by IWRB.

124 Identify and protect other occupied cold-water spring complexes in the Hagerman reach.

Additional cold-water spring complexes containing colonies of one or more of the listed snails and Shoshone sculpin currently exist, but remain unprotected within the vicinity of Hagerman on the Snake River. Additionally, remaining spring complexes need to be identified for conservation activities. Once identified, habitat management plans can be developed to identify conservation measures and management strategies necessary to provide long-term protection.

1241 Develop and implement habitat management plans for protecting additional, occupied spring habitats and complexes.

Habitat management plans should be developed in cooperation with "willing and interested landowners" for all additional, occupied spring habitat sites. These plans will identify conservation measures and potential funding mechanisms, management authorities, and monitoring requirements for implementation. Any habitat management plan should include establishment of minimum spring flows through the State minimum streamflow program, administered by IWRB.

125 Develop and implement a ground water management plan for the Snake River Plain aquifer to protect spring discharge.

A comprehensive ground water management plan (under development by IDWR) that protects spring discharges and water quantity is necessary to secure essential snail habitats. Part of this task could be accomplished through the IDWR's program to manage ground water in conjunction with interconnected surface waters.

The volume of water required to provide suitable spring flows from the regional Snake River aquifer must be determined in order to maintain essential cold-water spring habitats. These water volume requirements must be based on a sound conceptual model of the Snake River aquifer and must incorporate the ecological requirements of the 5 listed snails, as relates to flow, water temperature and other habitat parameters (see task # 321).

126 Continue the moratorium preventing further ground water appropriation.

The existing IDWR moratorium against further ground water appropriations should be continued until a Snake River basin-wide management plan is developed to secure and protect essential cold-water spring habitats. The IDWR moratorium (initially issued on May 1, 1992 and extended through 1997) and existing ground/surface water regulations were developed as part of the Idaho water rights policy and were not designed specifically to protect fish and wildlife resources.

13 Evaluate effects from exotic molluscs and fish on Snake River listed species.

To achieve recovery, the potential adverse affects of non-native fish and molluscs on the listed species should be addressed in aquatic habitats in the Snake River from rkm 834 (rm 518) upstream to rkm 1,150 (rm 714). In particular, the New Zealand mudsnail is considered a serious pest and potential competitor affecting recovery of the listed snails. The New Zealand mudsnail competes for habitat with Snake River physa, Idaho springsnail and mainstem colonies of Bliss Rapids snail and Utah valvata. This species is abundant from C.J. Strike Reservoir upstream to Bliss Dam, particularly in the mainstem of the Snake River. However, the mudsnail is not abundant in unpolluted, cold-water springs inhabited by Banbury Springs lanx and in most cold spring flows which support colonies of Bliss Rapids snail and Utah valvata.

The effects of non-native fish introductions on listed species in the Snake River drainage are uncertain and should be further evaluated. The escape and establishment of exotic species from tropical fish-farming operations could occur in this area.

131 Evaluate the feasibility of exotic mollusc and fish control programs.

A literature review should be conducted to identify potential control measures to eliminate nuisance fish and molluscs, especially the New Zealand mudsnail. Once this information is developed, a fish and/or mollusc control program should be developed and implemented that reduces or eliminates competition from exotic species.

132 Determine whether existing State importation regulations are effective in preventing additional non-native organisms from becoming established in Idaho.

Currently, aquaculturalists may import and culture almost any fish or mollusc. Some cultured species may pose serious problems to the native fauna if they escape and become established in the wild. This risk needs to be further evaluated. Measures that prevent additional introductions of non-native molluscs and fish should be developed and implemented.

2 Rehabilitate, restore and maintain water quality and watershed conditions to improve Snake River aquatic habitats.

Conditions within the middle Snake River watershed influence water quality, quantity and timing of flows in essential habitat areas. The Service, under the authority of the Act and the Fish and Wildlife Coordination Act, will work with Federal land managers to ensure that existing management activities and proposed watershed improvement projects are compatible with the recovery of the middle Snake River ecosystem.

21 Improve water quality through the CWA activities listed below, to restore and maintain the middle Snake River ecosystem below American Falls Dam.

The CWA requires development and implementation of several programs to protect, improve, and maintain water quality and aquatic habitats. Evaluation of these ongoing programs is needed to assure that efforts will lead to the recovery of the 5 listed snails and the middle Snake River ecosystem.

211 Nonpoint Source Management Plan.

Section 319 of the CWA requires states to prepare a Nonpoint Source Assessment Report and a Nonpoint Source Management Plan. Idaho's Nonpoint Source Management Plan should be evaluated to determine if current efforts have been successful in improving water quality, and if it will address recommended recovery goals and conservation measures included in this Plan.

212 Compliance of section 401 certification by the State with adequate water quality standards.

Section 401 of the CWA requires that any federally permitted action conducted in waters of the U.S. must comply with State water quality standards. However, current State water quality standards may be inadequate to achieve long-term recovery goals for improved water quality and aquatic habitat conditions in the Snake River. These standards may need to be amended as 401certification conditions.

213 NPDES Permits.

Section 402 of the CWA established the NPDES program, which regulates point source discharges into waters of the U.S. The program, administered by EPA in Idaho, should be managed to assure that recovery goals are met.

2131 Evaluate NPDES activities on listed species.

The Service recommends that EPA compile and summarize information about all NPDES permitted activities and associated permit limits in the Snake River below American Falls. This information will be useful in evaluating cumulative effects and if necessary, revising water quality standards to protect listed Snake River aquatic species.

2132 Conduct toxicity tests using hatchery effluent and associated sediment to determine effects on native molluscs.

Numerous fish hatcheries along the Hagerman reach of the Snake River discharge significant amounts of effluent, which contains nutrients and chemicals used in routine hatchery operations. The effects of these effluents on native molluscs needs to be determined. Laboratory tests may be needed to complete this task.

2133 Conduct sewage treatment wastewater toxicity tests.

Municipalities along the Snake River discharge effluent directly into the Snake River. Although these discharges are regulated through EPA's NPDES process, the potential for chronic and acute effects on native aquatic fauna should be determined. Sediments within the discharge area should also be tested for toxicity.

214 Evaluate the TMDL process and water quality limited segments.

Section 303 (d) of the CWA requires states to identify areas where water quality standards are not being met (water quality limited segments). The middle Snake River from Shoshone Falls to King Hill was designated water quality limited by DEQ in 1990. Once these waters are identified, the CWA requires the State to implement the TMDL process in order to determine the most effective pollution control methods. By considering all of the contributing sources, the TMDL limits the amount of pollution each source is allowed to release. At present, DEQ is proposing to implement an NMP and has requested that EPA accept the NMP in lieu of the TMDL (see task #524). Although the NMP is addressing one factor (nutrients such as nitrogen and phosphorus) limiting the middle Snake River, a TMDL will have to be implemented on the middle Snake River to address other limiting factors such as water quantity, temperature and sediment.

22 Enhance and restore watershed conditions in the Snake River ecosystem.

Managers of Federal lands along the Snake River, including BLM, BR, and the Service, should implement additional conservation measures as necessary to restore watershed conditions and improve water quality in tributaries entering the Snake River. Key watersheds and problem areas should be identified and monitored in order to evaluate the effects of activities in these areas on listed species. The Service will also evaluate the direct and indirect effects of Federal agency land management activities on listed species in the Snake River and adjacent cold-water spring habitats under section 7 of the Act.

221 Improve watershed conditions in areas where agricultural return flows intersect BLM lands.

Various management activities that occur on BLM lands can directly affect aquatic habitats in the Snake River. For example, water quality is degraded when livestock grazing along perennial streams reduces the ability of riparian areas to filter sediments and contaminants originating from agricultural return flows.

The Service will recommend that the Boise, Shoshone and Jarbidge BLM Districts inventory public lands and identify activities under their management that affect Snake River aquatic habitats. Following a complete inventory of these lands, BLM should develop habitat management plans, in cooperation with local interested parties and the Service, to eliminate possible adverse water quality effects on the Snake River ecosystem. These lands should be also protected from reclassification to agricultural lands.

222 Improve watershed conditions in areas where agricultural return flows intersect BR withdrawal lands.

Similar to recovery tasks recommended for BLM (task # 221), BR should inventory their lands adjacent to the Snake River and identify ongoing activities that may affect water quality and aquatic habitats. Following a thorough inventory of these lands, BR should develop a comprehensive habitat management strategy including management activities and conservation measures to assist with recovery. In addition to section 7 of the Act, this inventory and evaluation is authorized under the Fish and Wildlife Coordination Act.

223 Improve riparian habitat at water gap sites on Minidoka National Wildlife Refuge.

Minidoka National Wildlife Refuge provides BLM allotment permittees access to the middle Snake River through the use of water gaps (lanes that provide water access to livestock). These areas should be inventoried and evaluated for their effects on water quality in the middle Snake River. Efforts should be made to improve or protect riparian habitats and river banks from possible degradation.

224 Encourage enhancement and restoration of riparian and wetland habitats on private lands.

Private lands containing wetlands and riparian habitats along the Snake River should be identified and inventoried. The Service, in cooperation with willing and interested landowners, local SWCD and irrigation districts, will develop cooperative measures to restore wetland/riparian areas and improve water quality. These efforts may be initiated through the State Conservation Review Group process coordinated by the FSA, through the State Agricultural Water Quality program, or developed through the Partners for Wildlife, Private Lands Program.

3 Conduct research on ecology of native molluscs of the Snake River.

Recovery of the listed species in the Snake River can be achieved only by conserving the ecosystem in which they occur. A better understanding of the Snake River ecosystem, including the well-defined life history requirements of the listed species and inter- and intra-specific interactions is necessary for developing specific recovery criteria and evaluating the success of recovery measures.

31 Determine the present distribution and status of the 5 federally listed and 2 Species of Concern molluscs.

Additional ecological information is needed for the 5 listed snails throughout the Snake River above C.J. Strike Reservoir and in adjacent cold-water springs. A basin-wide cooperative survey of the Snake River benthos, specifically the native molluscs, should be conducted as soon as possible and financed by the various agencies with management authorities in the Snake River basin. A multi-agency cooperative survey using standardized procedures and techniques should serve to minimize conflicts between jurisdictions and reduce costs. Information gained from this survey will also be useful in section 7 consultations with Federal agencies involved in ongoing and future management activities affecting snail habitats along this stretch of the Snake River. The survey will update the status and distribution of the listed snail species and other mollusc species of concern. Information gained from this task, when combined with the results of task # 32, will be useful in determining population viability and habitat restoration goals to achieve reclassification and/or delisting (task # 41).

311 Develop and implement a cooperative basin-wide survey of Snake River molluscs.

Develop and implement a basin-wide survey as detailed in task # 31 above.

312 Study the effects of the 1993 Bliss landslide on Snake River aquatic species.

In 1993, a large (100+ acres) landslide along the north side of the Snake River south of Bliss (rkm 902, rm 560) deposited large amounts of sediment in the river. The slide caused water levels in the area to rise nearly 1.6 m (5 ft). Previously, the river reach downstream of the slide area provided limited habitat for known colonies of Idaho springsnail, Snake River physa and Bliss Rapids snail. BLM (1993) has proposed a water quality/habitat inventory program to study the effects of the slide on the listed snails. Some of this monitoring can be accomplished through the basin-wide mollusc survey (task # 31 and 32).

313 Verify the presence of the Bliss Rapids snail above American Falls.

In 1991, the Bliss Rapids snail was reported to occur in a single spring site near Ferry Butte on the Shoshone-Bannock Indian Reservation (rkm 1,207, rm 749.8). This isolated collection extended the known range of the Bliss Rapids snail by almost 260 rkm (162 rm). However, these individuals may have been misidentified, and may be a closely related hydrobiid snail. The Snake River reach above American Falls Dam should be included in the basin-wide mollusc survey, provided that access to the Shoshone-Bannock tribal lands is secured. In addition, the specimens from the Ferry Butte area collected in 1991 should be re-examined for positive identification.

314 Conduct additional snail surveys at Minidoka National Wildlife Refuge.

National Wildlife Refuges were developed in part "... to preserve, restore and enhance, in their natural ecosystems, all species of animals and plants that are endangered or threatened ...". Although Utah valvata snails occur at the Minidoka Wildlife Refuge, their current status and distribution are not well known. The Service should conduct surveys and incorporate conservation measures for Utah valvata into the Minidoka Wildlife Refuge Management Plan. This task can be partially achieved through task # 31.

32 Determine ecology and life history of 5 listed and 2 Species of Concern molluscs.

As previously stated, conservation measures designed to protect rare and/or threatened taxa are successful only when adequate information is available describing the physical and biotic components of their ecosystems. The ecosystems essential to the federally listed aquatic species and species of concern have been affected by habitat modification, fragmentation and deteriorating water quality. Recovery of the Snake River aquatic species will likely require restoration of suitable habitat not currently occupied within their historic range. Once the ecological requirements for these taxa are better defined, habitat restoration measures should be implemented that protect and maintain their essential habitats. This information will be partially accomplished through task # 31.

321 Describe habitat and life history requirements of native molluscs.

Micro- and macro-habitat requirements for the species should be further described, including information on appropriate water temperature, water chemistry, depth, current velocities, cover and substrate composition. Snail life history parameters should be further defined, including longevity, reproduction, food habits, growth and dispersal. This information will be useful in further refining the ecological requirements of these species and in determining population viability. This task may be accomplished using laboratory studies. For example, laboratory research may be useful to determine the longevity of the listed snails under varying environmental conditions. Results of this research could be useful for risk analysis that evaluates the ability of these species to survive catastrophic events.

4 Re-evaluate reclassification and/or delisting criteria of federally listed snails.

As initial recovery measures (see tasks #1-223) are accomplished and/or additional information regarding the ecology of the listed Snake River snails becomes available, more specific criteria to achieve reclassification and/or delisting will be established.

41 Determine population viability and habitat restoration goals to achieve reclassification and/or delisting of federally listed snails.

Additional information is needed to determine the amount of suitable habitat and number of snail colonies necessary to ensure long-term viability for reclassification and/or delisting. Most of this information will be gathered by completing recovery measures described in task # 31.

Four of the 5 listed snails currently occupy a small portion of their historical ranges. Additional information on their life histories, specific habitat requirements and current distribution, will allow the Service to determine the population recovery levels for the 5 listed and 2 Species of Concern molluscs. Long-term recovery criteria and objectives will be revised and updated as this information is developed (see task # 71).

42 Select monitoring sites within the recovery area for each of the listed snails.

Recovery will be based on detection of increasing or stable, self-reproducing colonies at pre-selected monitoring sites. These sites will be located within each of the listed species recovery areas for a 5-year period. The Service, in cooperation with appropriate State and Federal agencies and other interested parties, will select at least 3 monitoring sites (see Recovery Criteria for each species).

5 Additional research and evaluation should be consistent with long-term recovery objectives.

Recovery criteria and conservation measures developed for the Snake River species and ecosystem recovery are subject to modification and will be strengthened as new information is generated. This information is not necessarily critical to meet the immediate recovery objectives of preventing further population/habitat declines or extinction of the listed species. However, additional research and an evaluation of the current status of these species will be useful in defining long-term recovery objectives, developing reclassification or delisting criteria, and determining the effectiveness of conservation measures.

51 Use existing flow augmentation programs to benefit listed species recovery.

In 1993, BR completed formal consultation with NMFS to provide increased flows from Snake River storage to promote salmon recovery. Salmon migrations in the lower Snake and Columbia Rivers may benefit from modifying existing reservoir operations and flow augmentation procedures along the Snake River upstream of American Falls. Flow augmentation proposals will be thoroughly evaluated for effects on the 5 listed snails through the section 7 process. If flow augmentation is shown to be beneficial to both salmon and Snake River aquatic species recovery, the Service will cooperate with efforts to identify additional water supplies.

BR is currently participating with IDWR to formulate comprehensive plans for conservation, development, management and use of water in several major river basins, including the Snake River. The Service recommends that BR identify the potential for increasing year-round flows through implementing additional water conservation measures and fine-tuning current hydropower operations in the area. Additionally, BR should consult with the Service through section 7 of the Act on all existing river operations.

52 Evaluate State authorized initiatives investigating Snake River water quality.

521 Evaluate the State Comprehensive Plan for the middle Snake River.

The State Comprehensive Plan for the middle Snake River was adopted by the Idaho legislature in 1994. The Plan will be evaluated and reviewed every 5 years by IDWR. The Plan's ability to address Snake River ecosystem recovery goals and objectives as well as improve water quality should be considered during these evaluations.

522 Develop and implement water quality-based standards necessary to protect existing mainstem and spring habitats.

The Middle Snake River Water Quality Studies (conducted by EPA and DEQ) and life history and habitat research should be used to develop water quality goals essential to protect habitats and meet the recovery of the 5 listed snails. Basin-wide water quality standards outside the NMP and TMDL processes should be established and used as an evaluation tool for meeting recovery objectives of the listed species and the Snake River ecosystem.

523 The Ag Plan should be used to accomplish recovery objectives.

In 1991, the Ag Plan was revised by the Idaho Soil Conservation Commission, DEQ and AWQAC. The stated goal of the Ag Plan is to "restore and maintain the waters of Idaho impacted by agricultural nonpoint sources to the point of fully supporting identified beneficial uses." However, restoring the Snake River ecosystem and protecting the habitats of the 5 listed snails is not currently identified as a beneficial use. The Ag Plan should be revised to be consistent with Snake River ecosystem recovery objectives.

524 Evaluate the NMP for meeting recovery objectives.

The Idaho Nutrient Management Act (Idaho Code 39-105 (3) (o)) affirms the primary responsibility for nutrient management to the State and requires the development of local nutrient management plans based on hydrologic basin units. A draft middle Snake River NMP was prepared by DEQ and released for review and comment in 1995. EPA will have final approval authority in determining whether the NMP meets the requirements of the CWA and the TMDL process for controlling nutrient loads to the middle Snake River. The draft NMP is being evaluated to determine its effectiveness in maintaining essential habitats and in meeting recovery goals.

53 Identify potential wetland enhancement projects to improve water quality from irrigated agricultural return flows.

The Service, in cooperation with local irrigation districts, NRCS, and willing and interested landowners will identify irrigation return outflows along the Snake River and identify potential sites for wetland enhancement projects on private lands (e.g., through the Partners for Wildlife program). The Service will also evaluate opportunities for improving water quality conditions in the Snake River ecosystem.

Once potential wetland enhancement sites have been identified, a cooperative plan to develop and implement wetland enhancement projects should be prepared. Constructing these projects should lead to improved water quality conditions and recovery of the Snake River ecosystem.

54 Conduct acute and chronic toxicity tests to determine the effects of pollutants on listed and species of concern molluscs.

The use of surrogate mollusc species (i.e., non-listed species) should be investigated to determine the effects of pollutants on listed species and species of concern. A scientifically valid testing protocol should be established in consultation with EPA and DEQ. Results of toxicity testing will be incorporated into the NPDES permitting process.

541 Determine hydroelectric dam tailrace effects.

Hydropower projects can influence water quality by changing instream water temperatures and dissolved gas levels. Additionally these projects can dewater littoral snail habitats. The effects of such water quality and habitat changes on listed species and species of concern should be evaluated. Plant operations may need to be revised to reduce adverse affects on listed snails.

542 Conduct toxicity tests on non-point and/or agricultural drain flows.

Discharges from agricultural drains contain variable mixtures of chemicals and nutrients. The potentially toxic effects of sediments within the area of discharge on listed species and species of concern should be determined.

55 Implement a contaminants study at the Thousand Springs Preserve.

The Service's Environmental Contaminants Division will implement a contaminant and temperature survey of springs at TNC's Preserve to determine potential effects on listed snails and their habitat. Flows entering these springs come from irrigated pasture and farmland, a local fish culture facility, and a power generation plant.

56 Continue the NWQA Monitoring Program.

The Service supports continued funding and technical assistance of USGS's NWQA program for the Snake River basin. The goals of this program are to describe the status and trends in water quality in the upper Snake River, in an attempt to better understand the link between natural and human-induced factors affecting water quality. Results from this monitoring program will be useful in evaluating programs to improve habitat conditions in the Snake River basin.

57 Determine the feasibility of translocation and establishing additional snail colonies to augment recovery.

Once habitat restoration goals are accomplished, translocating snails to establish new colonies within their historic range may be used to facilitate the recovery process.

A survey of all potential cold-water springs should be conducted within the Snake River basin above C.J. Strike Reservoir to evaluate suitability for translocation of Bliss Rapids and Utah valvata snails. Emphasis should be placed on spring sites that occur on public lands or sites with interested and willing landowners. This task can be partially accomplished using information from tasks # 31, 32 and 321, and will involve describing various aquatic habitat attributes for each potential translocation site, including water temperature, dissolved oxygen, depth, velocity, substrate and food availability. This process can also be used for evaluating mainstem habitats that may be potentially suitable for translocation provided that water quality requirements are met.

571 If translocation is determined to be feasible, develop and implement a suitable translocation plan the for listed snails.

A draft translocation plan should be developed that describes how potential translocation sites will provide basic life history requirements for each of the listed species. The plan should identify viable snail colonies from which specimens can be obtained for translocation. Following the guidelines of this plan, snails may be introduced into suitable habitats in the Snake River and adjacent cold-water springs. For example, Bliss Rapids snail translocation between rkm 880 and 1,085 (rm 547 and 674.5) may be appropriate as suitable habitat is recovered. This program will require a section 10(A)(1)(a) permit from the Service.

572 Monitor translocated snail colonies and habitats.

To determine the success of translocation, newly colonized spring sites should be monitored according to standardized monitoring protocols.

6 Conduct research on the ecology of the native fishes of the Snake River.

Additional information is needed on the status and essential habitats required by native fish including the white sturgeon, Shoshone sculpin and trout. This information will likely contribute to recovery measures for the 5 listed snails. This research should occur prior to the development of any new conservation measures or revisions in State fish habitat management plans.

61 Conduct research on the ecology of the Snake River white sturgeon.

The distribution of white sturgeon in the Snake River is generally well known. However, little information exists on the current status and habitat requirements of this species. Annual monitoring of white sturgeon spawning and movement/migration will be necessary to determine the effects of the proposed recovery measures for the 5 listed snails on recruitment and survival in impounded sturgeon populations found above C.J. Strike Dam.

611 Continue IPC's white sturgeon studies and monitoring.

The IPC is currently conducting sturgeon studies pursuant to the relicensing of 3 hydroelectric projects on the Snake River between C.J. Strike and Bliss Dam. Study objectives are to determine the population status, habitat use, and spawning success of juvenile and adult sturgeon under current operating conditions. This study, initiated in 1991, was completed in 1995 for the Bliss and Wiley reaches above C.J. Strike Dam. The results of this study and annual monitoring to detect sturgeon spawning and recruitment for all impounded reaches below Twin Falls Dam will be used to better evaluate the effects of hydropower operations. This monitoring program should be a cooperative effort between IPC, IDFG, FERC, and BR.

A population and habitat monitoring program should be initiated for the river reach upstream of Upper Salmon Falls Dam to Shoshone Falls. Very little is known about the status of white sturgeon in this reach. This research would also provide information on habitat availability and determine the need for habitat improvement.

62 Conduct research on the ecology of the Shoshone sculpin.

The Shoshone sculpin is known from 26 cold-water spring or spring-stream systems along a 55 km (34 mi) reach of the Snake River upstream of Bliss Dam. One or more of these cold-water springs contain populations of the listed species. Additional research is needed on life history requirements and factors regulating population structure. Habitat monitoring and conservation measures implemented for the 5 listed snails should also provide protection for remaining sculpin populations and their habitats (see task #12).

621 Ensure Shoshone sculpin habitat protection through recovery actions.

Habitat supporting Shoshone sculpin can be protected from modification, vandalism, and catastrophic events through implementation of recovery task #12 and the enforcement of existing State and Federal laws and regulations.

63 Protect remaining native cutthroat and redband trout habitats in the Snake River basin.

Mainstem Snake River habitats suitable for native resident salmonids are generally in poor condition with remnant, naturally-reproducing trout populations restricted primarily to cold-water spring inflows and a few tributary streams. For example, recent surveys on the Snake River found that non-native species dominate the fish fauna throughout the mainstem river.

631 Monitor the population and genetic status of the Vineyard Creek cutthroat trout.

This research would determine the distribution, abundance and habitat availability of this subspecies in Vineyard Creek, a spring-stream immediately upstream of Twin Falls.

Because some researchers have suggested that Vineyard Creek trout are hybrids and not a distinct genetic stock, the Service recommends that genetic analysis of this population be conducted by IPC during the relicensing process.

632 Determine the status of remnant redband trout in Snake River tributaries.

The IDFG has identified populations of redband trout in Bennett Creek, Cold Springs Creek, Little Canyon Creek, King Hill Creek, Clover Creek, Jacks Creek and the Bruneau River, all of which flow into the recovery reach. Further research by IDFG and BLM should determine the distribution, abundance and habitat availability for this rainbow trout subspecies.

633 Identify additional conservation measures to protect unique trout stocks between C.J. Strike Reservoir and American Falls Dam.

The IDFG, using information garnered from tasks #631 and 632, should identify additional conservation measures necessary to maintain unique naturally-reproducing cutthroat, rainbow, and redband trout stocks within the Snake River ecosystem below American Falls Dam. These measures can be incorporated into the IDFG Fisheries Management Plan for the Snake River basin above C.J. Strike Reservoir.

7 Monitoring and recovery plan assessment.

The response of the 5 listed snails and the Snake River ecosystem to the conservation measures associated with this recovery effort will be determined by developing a long-term species and habitat monitoring program. Although much of this monitoring can be accomplished by expanding ongoing State and Federal evaluation programs, additional monitoring may be necessary.

71 Biennially assess the overall success of the recovery program and revise the recovery plan on a 5-year basis, if necessary.

The Plan should be updated on a 5-year basis as recovery tasks are accomplished, or revised as environmental conditions change or additional information becomes available. The Plan assessment can be achieved formally through biennial agency review/meetings where annual monitoring reports and summaries are submitted and evaluated, or informally through distribution of annual monitoring reports and summaries submitted to the Service by the various agencies.

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PART IV. IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and estimated costs for the recovery program. It is a guide to meet the objectives of the Snake River Aquatic Species Recovery Plan. This schedule indicates the priority in scheduling tasks to meet the objectives, which agencies are responsible, a time-table to accomplish these tasks, and the estimated costs. Implementation of these actions should halt further habitat decline and initiate recovery of the 5 listed Snake River snails and the Snake River ecosystem. Initiation of these actions is subject to the availability of funds. During review of the technical draft of the Snake River Aquatic Species Recovery Plan, agencies were requested to provide cost estimates of actions they would implement.

Recovery Task Priorities in Column 1 of the following implementation schedule are assigned as follows:

Priority 1 - An action that must be taken to prevent extinction or to prevent the threatened and endangered species from declining irreversibly.

Priority 2 - An action that must be taken to prevent a significant decline in the species population/habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to meet the recovery objectives.

RECOVERY PLAN IMPLEMENTATION SCHEDULE
SNAKE RIVER AQUATIC SPECIES

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES ($000) Total Cost	FY 95	FY 96	FY 97	FY 98	FY 99	COMMENTS
1	111	Prevent further diversion of surface flows in the Snake River basin.	1	ES,IDWR,FERC	**						Use existing State law, FERC regulations, and Section 7.
1	112	Use existing authorities to conserve aquatic habitats through the FERC licensing and relicensing regulations.	ongoing	ES,FERC,COE							Use Section 7 and other existing authorities. Costs are for Service review and responsibilities.
1	1131	Use existing authorities and mechanisms to establish instream flows for the S.R., including the purchase and transfer of existing water rights from the Water Supply Bank.	5	IWRB*,ES IDFG	912	183	183	183	183	183	
1	1132	Evaluate the potential effects of S.R. Basin Adjudication on listed species recovery.	4	IDWR,ES	96		1.5	1.5	1.5	1.5	Cost for ES involvement only.
1	121	Continue TNC's habitat management program at the 1000 Springs Preserve.	ongoing	TNC	**						Several measures have been implemented to date.
1	1221	Develop and implement a habitat management plan for the Banbury Springs complex.	1	IPC*,ES	4		4				Cost for ES involvement only, other costs will be determined by IPC.
1	123	Protect the Box Canyon springs complex.	1	BLM*,PRI,ES	4		4				Cost for ES involvement only.
1	1241	Develop and implement habitat management plans for protecting additional spring habitats and complexes.	4	ES*,BLM,IPC BR,PRI	25	10	5	5	5		Cost-share project.
1	125	Develop and implement ground water management plan for the Snake River Plain aquifer to protect spring discharge.	3	IDWR*,USGS, EPA,DEQ,ES, IDFG	30	10	10	10			Cost-share project.

* - Lead Agency
** - Actions authorized by other agency budgeting authority
*** - Costs associated as part of previous task

unk - Cost estimates were requested from agencies during comment period, costs remain unknown
ongoing - Task is currently being implemented and will continue until action no longer necessary for recovery
continual - Task will be implemented on an annual basis once it is funded

RECOVERY PLAN IMPLEMENTATION SCHEDULE
SNAKE RIVER AQUATIC SPECIES

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES ($000) Total Cost	FY 95	FY 96	FY 97	FY 98	FY 99	COMMENTS
1	126	Continue the moratorium preventing further ground water appropriation.	ongoing	IDWR	**						
1	211	Nonpoint Source Management Plan.	1.5	DEQ*,EPA	**						
1	212	Compliance of Section 401 Certification by the State with adequate water quality standards.	1.5	DEQ*,EPA	**						Review of monitoring programs.
1	2131	Evaluate NPDES activities on listed species.	5	EPA*,ES	15	3	3	3	3	3	Costs for ES Section 7 review and monitoring only.
1	2132	Conduct toxicity tests of hatchery effluent to determine effects on native molluscs.	2	EPA*,PRI,ES	292	146	146				
1	2133	Conduct sewage treatment wastewater toxicity tests.	2	EPA*,DEQ	**						May be partially accomplished through task #2132.
1	214	Evaluate the TMDL process and water quality-limited segments.	1	EPA*,DEQ,ES	unk						Task conducted in 1998.
1	221	Improve watershed conditions where agricultural return flows intersect BLM lands.	5	BLM*,PRI,ES	**						Use Section 7 & landowner cooperation.
1	222	Improve watershed conditions where agricultural return flows intersect BR withdrawal lands.	5	BR*,PRI,ES	**						Use Section 7 & landowner cooperation.
1	223	Improve riparian habitat at water gap sites on Minidoka Wildlife Refuge.	5	Refuge*,BLM,ES	**						Use Section 7 & landowner cooperation.
1	224	Encourage enhancement and restoration of riparian and wetland habitats on private lands.	5	ES*,PRI NRCS,FSA	10	2	2	2	2	2	ES will coordinate with local SCS & ASCS offices.

* - Lead Agency
** - Actions authorized by other agency budgeting authority
*** - Costs associated as part of previous task

unk - Cost estimates were requested from agencies during comment period, costs remain unknown
ongoing - Task is currently being implemented and will continue until action no longer necessary for recovery
continual - Task will be implemented on an annual basis once it is funded

RECOVERY PLAN IMPLEMENTATION SCHEDULE
SNAKE RIVER AQUATIC SPECIES

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES ($000) Total Cost	FY 95	FY 96	FY 97	FY 98	FY 99	COMMENTS
1	311	Develop and implement a cooperative basin-wide survey of Snake River molluscs.	3	ES,BR,COE, FERC,IPC,EPA, IDFG, BLM, NRCS,FSA	400	100	200	100			Cost-share project anticipate one year to develop survey.
1	312	Study the effects of the 1993 Bliss landslide on Snake River aquatic species.	1	BLM*,ISU,COE	37	37					
1	321	Describe habitat and life history requirements of native molluscs.	3	ES,BR,COE FERC,IPC,ISU U of I	135	40	45	50			Cost-share project, conduct as part of task #311.
1	41	Determine population viability and habitat restoration goals to achieve reclassification and/or delisting of Federally listed snails.	1	ES*, others	unk						Task will be conducted after completion of task #'s 311 & 321; task completed by 1998.
1	42	Select monitoring sites within the recovery area for each of the listed snails.	5	ES, BR, IPC	unk						

* - Lead Agency
** - Actions authorized by other agency authority.
*** - Costs associated as part of previous task

unk - Cost estimates were requested from agencies during comment period, costs remain unknown
ongoing - Task is currently being implemented and will continue until action no longer necessary for recovery
continual - Task will be implemented on an annual basis once it is funded

RECOVERY PLAN IMPLEMENTATION SCHEDULE
SNAKE RIVER AQUATIC SPECIES

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES ($000) Total Cost	FY 95	FY 96	FY 97	FY 98	FY 99	COMMENTS
2	131	Evaluate the feasibility of mollusc and fish control programs.	5	IPC,FERC*,BR IDFG,ES,EPA IDA	10	2	2	2	2	2	Create working group to explore management options.
2	132	Determine if existing State importation regulations are effective in preventing additional nuisance organisms from becoming established in Idaho.	1	IDFG*,ES IDA	1.2		1.2				Regulatory review & recommend legislative action.
2	313	Verify presence of Bliss Rapids snail above American Falls Dam.	0.25	FERC,BR*,COE, Tribe	***						Conduct as part of task #311.
2	314	Conduct additional snail surveys at Minidoka National Wildlife Refuge.	0.25	ES*,BR,FERC	15*		15				Conduct as part of task #311.
2	51	Use existing flow augmentation programs to benefit listed species recovery.	4	BR*,ES,NMFS IPC,FERC,BPA, IDFG,IDWR	60	20	20	10	10		Cost-share project
2	521	Evaluate the State Comprehensive Plan for the Middle Snake River.	ongoing	IDWR*,others	**						
2	522	Develop and implement water quality-based standards necessary to protect existing mainstem and spring habitats.	ongoing	EPA,DEQ	**						
2	523	Use the Ag Plan for meeting recovery objectives.	1	DEQ*,AWQAC	**						Follow-up to revise Ag Plan.
2	524	Evaluate the Nutrient Management Plan for meeting recovery objectives.	1	EPA*,DEQ	2	2					Monitor for effectiveness, costs for ES review and monitoring only
2	53	Identify potential wetland enhancement projects to improve water quality from irrigated agricultural return flows.	ongoing	ES,NRCS*PRI FSA,EPA	**						SCS to work with interested parties and soil conservation districts.

* - Lead Agency
** - Actions authorized by other agency budgeting authority
*** - Costs associated as part of previous task

unk - Cost estimates were requested from agencies during comment period, costs remain unknown
ongoing - Task is currently being implemented and will continue until action no longer necessary for recovery
continual - Task will be implemented on an annual basis once it is funded

previous task
ongoing - Task is currently being implemented and will continue u
action no longer necessary for recovery
continual - Task will be implemented on an annual basis once it is funded

RECOVERY PLAN IMPLEMENTATION SCHEDULE
SNAKE RIVER AQUATIC SPECIES

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES ($000) Total Cost	FY 95	FY 96	FY 97	FY 98	FY 99	COMMENTS
2	541	Determine hydroelectric dam tailrace effects	2	IPC*,FERC,BR	**						Will be partially completed through Section 7 consultation with FERC.
2	542	Conduct toxicity tests on non-point and/or agricultural drain flows.	2	EPA,DEQ	**						Laboratory tests will be required.
2	55	Implement a contaminants study at the TNC's Thousand Springs Preserve.	1	ES*	76	55					Project started in 1994.
2	56	Continue the NWQA Monitoring Program.	1	USGS**	75	75					Project started in 1993.
2	71	Biennially assess the overall success of the recovery program and revise the recovery plan on a 5-year basis.	ongoing	ES*,others	16		8	8			

* - Lead Agency
** - Actions authorized by other agency budgeting authority
*** - Costs associated as part of previous task

unk - Cost estimates were requested from agencies during comment period, costs remain unknown
ongoing - Task is currently being implemented and will continue until action no longer necessary for recovery
continual - Task will be implemented on an annual basis once it is funded

RECOVERY PLAN IMPLEMENTATION SCHEDULE
SNAKE RIVER AQUATIC SPECIES

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES ($000) Total Cost	FY 95	FY 96	FY 97	FY 98	FY 99	COMMENTS
3	571	If translocation is determined to be feasible, develop and implement a suitable translocation plan for listed species.	1	ES*,IPC,BR	20			20			Develop after suitable sites are located.
3	572	Monitor translocated snail colonies and habitats.	ongoing	ES,IPC,BR FERC	30				15	15	
3	611	Continue IPC's white sturgeon studies & monitoring.	ongoing	IPC*,FERC IDFG	261	30	33	72	81	45	Ongoing study to continue with upstream assessment to begin in 1996.
3	621	Ensure Shoshone sculpin habitat protection through recovery actions.	2	IDFG*,IPC ES,ISU,PRI	**		**				Costs will be associated with 1221 and 1241.
3	631	Monitor the population and genetic status of the Vineyard Creek cutthroat trout.	2	IPC,IDFG	15	10	5				
3	632	Determine the status of remnant redband trout in S.R. tributaries.	2	IDFG*,BLM	10	5	5				Begins in 1995.
3	633	Identify additional conservation measures to protect unique trout stocks between C.J. Strike Reservoir and American Falls Dam.	1	IDFG	unk						Complete prior to 1996 to 2000 Fisheries Management Plan; costs associated with land and water rights purchases.

* - Lead Agency
** - Actions authorized by other agency budgeting authority.
*** - Costs associated as part of previous task

unk - Cost estimates were requested from agencies during comment period, costs remain unknown
ongoing - Task is currently being implemented and will continue until action no longer necessary for recovery
continual - *Task will be implemented on an annual basis once it is funded*

PART V. APPENDICES

APPENDIX A. Current fish fauna of the Snake River drainage. An asterisk (*) precedes the name of non-native taxa (Simpson and Wallace 1982, Bowler et al. 1992, Bowler and Frest 1992).

Petromyzontidae	
Lampetra tridentata tridentata (extinct from the mid-Snake River)	Pacific lamprey
Acipenseridae	
Acipenser transmontanus (Resident)	white sturgeon
Salmonidae	
Oncorhynchus clarki (subspecies uncertain)	cutthroat
Oncorhynchus nerka (extinct from the mid-Snake River)	sockeye salmon/kokanee
Oncorhynchus kisutch (extinct from the mid-Snake River)	coho salmon
Oncorhynchus mykiss (Resident)	rainbow trout
Oncorhynchus sp.	redband trout
Oncorhynchus tshawytscha (extinct from the mid-Snake River)	chinook salmon
Prosopium williamsoni	mountain whitefish
Salvelinus confluentus (status unknown)	bull trout
* Salmo trutta	brown trout
* Salvelinus fontinalis	brook trout
Cyprinidae	
Acrocheilus alutaceus	chiselmouth
* Carassius auratus	goldfish
* Cyprinus carpio	carp
Gila atraria	Utah chub
Gila bicolor	Tui chub
Gila copei	leatherside chub
Mylocheilus caurinus	peamouth
* Pimephales promelas	fathead minnow
Ptychocheilus oregonensis	Northern squawfish
Richardsonius balteatus	redside shiner
Rhinichthys cataractae	longnose dace
Rhinichthys falcatus	leopard dace
Rhinichthys osculus	speckled dace

APPENDIX A. CONTINUED

Catostomidae	
Catostomus ardens	Utah sucker
Catostomus columbianus	bridgelip sucker
Catostomus discobolus	bluehead sucker
Catostomus macroheilus	largescale sucker
Cichlidae	
* Tilapia zilli	tilapia
Ictaluradae	
* Ictalurus punctatus	channel catfish
* Ameiurus nebulosus	brown bullhead
* Ameiurus melas	black bullhead
* Ictalurus furcatus	blue catfish
Poeciliidae	
* Gambusia affinis	mosquitofish
Centrarchidae	
* Lepomis gibbosus	pumpkinseed
* Lepomis machochirus	bluegill
* Lepomis gulosus	warmouth
* Micropterus salmoides	largemouth bass
* Micropterus dolomieu	smallmouth bass
* Pomoxis nigromaculatus	black crappie
Percidae	
* Perca flavescens	yellow perch
* Stizostedion vitreum	walleye
Cottidae	
Cottus bairdi	mottled sculpin
Cottus beldingi	Piute sculpin
Cottus cognatus	slimy sculpin
Cottus confusus	shorthead sculpin
Cottus greenei	Shoshone sculpin
Cottus rhotheus	torrent sculpin

APPENDIX B. Aquatic molluscs of the Snake River from C.J. Strike Dam upstream to Milner Dam. The compilation of species presented below reflects information from Frest and Bowler (1992). Native molluscs which characteristically require cold, fast water or sediments in free-flowing habitats are indicated in bold face, while many of the other species are more tolerant of eutrophic, warmer conditions. An asterisk (*) precedes the name of non-native taxa. Species considered by the Service to be species of concern are indicated by a SC before the taxonomic name. Federal listed species are indicated by a T (Threatened) or an E (Endangered).

CLASS GASTROPODA (SNAILS)

Ancylidae

Ferrissia parallelus
Ferrissia rivularis

Hydrobiidae

SC **Fluminicola columbiana**
Fluminicola hindsi
* Potamopyrgus antipodarum
E **Pyrgulopsis (=Fontelicella)idahoensis**
T **Taylorconcha serpenticola**

Lancidae

Fisherola nuttalli
E **Lanx n. sp.** (Banbury Springs lanx)
Fossaria (Bakerilymnea) bulimoides
Fossaria (B.) dalli
Fossaria (F.) exigua
Fossaria (F.) modicella
Fossaria (F.) parva
Fossaria (F.) obrussa
Stagnicola (Hinkleyia) caperata
Stagnicola (S.) catascopium
Stagnicola (S.) hinkleyi
* Radix auricularia

Physidae

Physa mexicana
E **Physa natricina**
Physella (Physella) gyrina
Physella (Costatella) integra

Planorbidae

Gyraulus (Torquis) parvus
Planorbella (Piersoma) subcrenatum
Promenetus exacuous
Vorticifex effusus

Valvatidae

Valvata humeralis
E **Valvata utahensis**

CLASS BIVALVIA (CLAMS)

Corbiculidae

* Corbicula fluminea

Margaritiferidae

Margaritifera falcata

Sphaeriidae

Musculium lacustre
Musculium securis
Pisidium (Cyclocalyx) caesertanum
Pisidium (C.) compressum
Pisidium (Neopsidium) insigne
Pisidium (C.) nitidum
Pisidium (C.) pauperculum
Pisidium (N.) punctatum
Pisidium (C.) variabile
Sphaerium nitidum
Sphaerium patiella
Sphaerium striatinum

Unionidae

SC **Anodonta californiensis**
Gonidea angulata

APPENDIX C. Location, history, natural history and water use history of the middle Snake River.

LOCATION AND HISTORY

For the purposes of this recovery plan, the middle Snake River is defined as the reach between C.J. Strike Reservoir (rkm 834, rm 518) upstream to American Falls Dam (rkm 1,150, rm 714) (Figure 1). This reach of the Snake River includes approximately 321.8 km (200 mi). The four largest tributaries to the middle Snake River are Rock Creek, Salmon Falls Creek, the Malad River, and Clover Creek. Numerous small tributaries and springs also occur along this stretch of the river (IWRB 1993).

The Snake River flows through what is commonly referred to as the Snake River Plain, part of the Columbia Intermontane physiographic province. The Plain stretches west to the Owyhee Mountains near the Oregon border, north to the southern edge of the central Idaho mountains, east to the foothills of the Rocky Mountains and south to the Great Basin uplift in southern Idaho. The Plain is 80 to 200 km (50 to 125 mi) wide, flanking either side of the river, and extends 640 km (400 mi) in an east/west direction. Elevations range from 640 to 1,829 m (2,100 to 6,000 ft). The present course of the Snake River is along the southern portion of the Snake River Plain. The relatively flat surface of the Plain generally slopes westward, and makes the Snake River one of North America's highest gradient large rivers. From Milner Dam (rkm 1,028, rm 639) downstream to the community of King Hill (rkm 881, rm 547), the Snake River flows through a deep, often vertical-walled basalt canyon cut in the Snake River Plain (IWRB 1993).

Immediately above Milner Dam, the Snake River is slightly below the level of the Snake River Plain. Below Milner Dam the river has cut a canyon 122 m (400 ft) deep. At Shoshone Falls (rkm 990, rm 615) the river drops another 65 m (212 ft). Approximately 15,000 years ago, overflow from Lake Bonneville scoured the Snake River Canyon. The floodwater cleaned the canyon and adjacent uplands of rock debris, eroded alcoves and scablands, and deposited huge bars of sand and gravel with boulders over 3 m (10 ft) in diameter. Most rapids in the area are a result of a large number of boulders deposited at or below a slight widening of the canyon during the Bonneville Flood (IWRB 1993). During this period, the climate of Idaho was cooler and wetter than it is today. The Snake River Plain supported extensive shallow lakes and marshlands. With the disappearance of glacial ice in northern and central Idaho, the climate gradually became warmer and drier.

From Twin Falls downstream to King Hill, the river remains 122 to 183 m (400 to 600 ft) below the general elevation of the Snake River Plain. The canyon gradually widens downstream of Twin Falls to include small areas of bottomland and terraces. The largest of the areas is the Hagerman Valley, which is approximately 19 km (12 mi) long and varies in width from 1.6 to 6.4 km (1 to 4 mi). Four major waterfalls occur in the Snake River reach: Star Falls, which drops 11 m (36 ft), Auger Falls [17 m (55 ft)], Twin Falls [40 m (130 ft)], and Shoshone Falls [65 m (212 ft)] (IWRB 1993).

The largest inflow of water to the Snake River downstream of Milner Dam is from the outflows of springs originating from the Snake River Plain aquifer on the north and east sides of the canyon (IWRB 1993). Water in the aquifer flows primarily in an east-to-west direction and is principally stored in and transmitted through fractures, gas-bubble voids, and lava tubes formed during the flowing and cooling of molten volcanic rock, and permeable ash and soil interbeds deposited between flows. The aquifer, one of the largest ground water systems in the U.S., underlies the Snake River Plain from the vicinity of St. Anthony, Idaho to the western end of the middle Snake River. Most aquifer ground water moves in the upper 61 to 152 m (200 to 500 ft) of basalt underlying the Plain. The channel of the Snake River cuts through the upper surface of this aquifer. Physical characteristics of the rocks of the Snake River Plain provide a highly reliable and productive source of ground water. An estimated 250,000 to 370,000 million m^3 (200 to 300 million ac-ft) of water is stored in the upper 152 m (500 ft) of the aquifer. Spring discharge between Milner Reservoir and King Hill equals approximately two-thirds of the total ground water released from the aquifer (IWRB 1993).

The north wall of the Snake River canyon contains numerous seeps, especially in the Hagerman area. Several large spring complexes occur along a 16.2 km (10 mi) reach of the river, including Malad, Blue, Sand, Box Canyon, Minnie Miller, and Niagara Springs. The springs exist because basalt lava flows rapidly absorb surface water, and the Snake River Plain has a very gentle southward tilt. At present, the principal source of water for the aquifer is percolation from irrigation and losses in irrigation canals and ditches. Also, water draining from the mountains of central Idaho soaks into the basalt and flows along the north edge of the Snake River Plain (IWRB 1993).

Of the 65 springs in the U.S. that have an average discharge of more than 2.83 cubic meters per second (m^3/s) (100 cfs), 11 occur along the middle Snake River. The average discharge from two of these springs, Thousand Springs and Malad Springs, each exceeds 28.32 m^3/s (1,000 cfs) (Kjelstrom 1992).

The native human inhabitants of southern Idaho included the Bannock, Shoshone and northern Paiute. Direct contact with explorers occurred in the early 1800's through fur trading and trapping activities. Westward expansion resulted in the creation of the Oregon Trail, crossing southern Idaho along the Snake River (IPC 1990).

By the 1860's, mining was an active industry in Idaho followed by an influx of Euro-American homesteaders. Later in the century with the introduction of irrigation by early settlers, agriculture became the major land use of the Snake River Plain.

NATURAL HISTORY

The Snake River currently includes two distinct aquatic habitats: reservoir or impounded habitats, and free-flowing or riverine habitats. There are distinct physical and biotic differences between these serially connected habitats within the Snake River ecosystem.

A. Aquatic Communities

Prior to the development of hydroelectric dams and impoundments and the regulation of flows, the Snake River fauna included large migrations of chinook salmon, steelhead, anadromous sturgeon and Pacific lamprey. Shoshone Falls (rkm 990, rm 615) presented a natural upstream barrier to migratory fish species. Today, several of these fish are extinct in the middle Snake River or are considered sensitive by the IDFG. The Shoshone sculpin (Cottus greenei) and redband trout (Oncorhynchus mykiss gairdneri) are Federal species of concern (Table 1). In addition to native fish, approximately 2 dozen non-native fish species are now found in the middle Snake River reach (Appendix A). According to Dey and Minshall (1992), the benthic community is dominated by taxa that indicate generally degraded conditions, including Chironomidae, Oligochaeta, Hyallela and Hydra. Species richness and diversity values tend to be low in the Snake River indicating poor water quality and low biological diversity.

Seventy percent of the middle Snake River is open water, with macrophyte beds occupying 20% of the surface area. Hill (1991) concluded that nonpoint and point source nutrient and sediment impacts promote macrophyte growth in the middle Snake River, especially during the low-flow, summer irrigation season.

Current information regarding mollusc distribution in the Snake River system indicates approximately 42 native molluscs, including 27 species of snails in 6 families and 15 species of clams in 4 families (Appendix B). Eighteen of these are considered to be cold-water species. Many of the species are relicts of the Pliocene Lake Idaho and Pleistocene lakes and rivers that formed after Lake Idaho was drained (Frest and Bowler 1992).

B. Vegetation Communities

The Snake River Plain is located within the rain shadow of the Sierra Nevada and Cascade Mountain ranges. The available water (which is determined by the rain shadow effect), distribution of soil types, and slope aspect influences the distribution of plant communities in the Snake River Plain. Two major plant communities occur along the Snake River, including the sagebrush/grass cold-desert association and the forested-shrub/scrub wetlands associated with free-flowing rivers and streams or near-surface ground water (B&C Energy 1984). The dominant species of the sagebrush/grass communities include big sagebrush (Artemesia tridentata), cheatgrass (Bromus tectorum), and Sandberg's bluegrass (Poa sandbergii). The forested-shrub/scrub wetland areas are dominated by a mixture of forested palustrine, emergent and scrub/shrub species, including sandbar willow (Salix exigua), Pacific willow (Salix lasiandra), russian olive (Elaeagnus augustifolia), cattail (Typha latifolia), Wood's rose (Rosa woodsii), and various sedges (Carex spp.) (B&C Energy 1984). Aquatic and shoreline plant species present in the Snake River are listed in Table 2.

Table 1. Federal and State status of animal species in the mid-Snake River, Idaho. Species with an asterisk (*) are Snake River stocks of salmon that have been eliminated from the mid-Snake River since 1912 due to construction of Swan Falls Dam.

	Federal	State
Idaho springsnail (Pyrgulopsis idahoensis)	E	
Utah valvata snail (Valvata utahensis)	E	
Snake River physa snail (Physa natricina)	E	
Banbury Springs lanx (Lanx n. sp.)	E	
Bliss Rapids snail (Taylorconcha serpenticola)	T	
California floater (Anodonta califoriensis)	SC	
Columbia pebblesnail (Fluminicola columbiana)	SC	
White sturgeon (Acipenser transmontanus)		SSC
Shoshone sculpin (Cottus greenei)	SC	SSC
Redband trout (Oncorhynchus mykiss gairdneri)	SC	SSC
* Snake River sockeye salmon (Oncorhynchus nerka)	E	
* Snake River fall chinook salmon (Oncorhynchus tschawyscha)	E	
* Snake River spring/summer chinook salmon (Oncorhynchus tschawyscha)	E	

E (endangered): Taxa in danger of extinction throughout all or a significant portion of their range.

T (threatened): Taxa likely to be classified as endangered within the foreseeable future throughout all or a significant portion of their range.

SC (species of concern): Taxa for which information now in the possession of the U.S. Fish and Wildlife Service indicates that proposing to list as endangered or threatened is possibly appropriate.

SSC (Species of Special Concern): State designation for native species which are low in numbers, limited in distribution, or have suffered significant habitat losses.

Table 2. Aquatic and shoreline vegetation of the Snake River (Dey and Minshall 1992). Asterisks indicate common species.

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*Salix lasiandra
*Populus trichocarpa
Rumex persicarloides
Vicia americana
Glycyrrhiza lepidota
Apocynum cannabinum
Verbena hastata
*Nepeta cataria
Mentha arvensis
*Solanum triflorum
~~*Veronica~~ americana
*Solidago ~~missouriensis~~
Helenium autumnale
Xanthium pennsylvanicum
*Bidens cernuas
Artemisia
Sarcobatus
Phragmites communis
*Paspalum distichum
Polypogon monspeliensis
*Cyperus strigosus
Eleocharis palustris
*Scirpus validus
*Typha latifolia
Polygonum natans
Polygonum lapathifolium
Sagittaria sp.
Potamogeton epihydrus
*Ceratophyllum demersum
Rorippa nasturtium
Anacharis sp.
Lemna minor
Azolla sp.
Toxicodendron diversiloba
Potamogeton crispus
Potamogeton foliosus (possible)
Elodea nuttali
Elodea canadensis
Ranunculus spp.
Meriophyllum spicatum

WATER USE HISTORY

A. Irrigation

Early irrigation development was limited to the Snake River canyon and several tributary streams. Large scale irrigation began in the early 1900's under the provisions of the Carey Act of 1894 and the Reclamation Act of 1902, which allowed the transfer of public lands to individuals for private reclamation projects. Federal involvement provided coordination and funding for construction of dams, reservoirs, and canals which helped expand the amount of irrigated acreage in the western U.S.. The Twin Falls project was one of the largest projects developed under the Carey Act. In 1903, the Twin Falls Land and Water Company began construction of the Low-Line Canal and Milner Dam. The first water deliveries began in the spring and summer of 1905. On the north side of the Snake River additional Carey Act projects were initiated by the Twin Falls Land and Water Company. By 1920, the North Side Irrigation Project consisted of 160 km (100 mi) of main canal and 1,280 km (800 mi) of laterals (IWRB 1993).

Water rights for most of the unregulated flow in the Snake River were decreed by 1908, and in low water years supplies were inadequate. Early irrigation development used the entire available natural flow in the river at some points (Milner and Blackfoot, for example) and resulted in reaches of the river that were dewatered for much of the late irrigation season (IDWR in litt., 1994). Supply was ultimately augmented by federally financed construction of additional water storage dams and reservoirs in the upper Snake River basin. Delivery of stored water provided continuous flows to the reach at Blackfoot and elsewhere. After World War II, ground water received greater attention as a major supply of additional water (IWRB 1993).

The average annual flow of the Snake River above Heise is 6,167 million m^3 (5.0 million ac-ft). The Henry's Fork and its tributaries add another 2,775 million m^3 (2.25 million ac-ft) per year before diversions. These water supplies are reduced by withdrawals at Milner to an average flow of 3,084 million m^3 (2.5 million ac-ft) per year. At Milner, flows vary widely from year to year. When Lake Walcott and Milner Reservoir are being filled or canal diversions begin, flows passing Milner have historically been reduced to virtually zero. With the start of operation of IPC's Milner power plant, a target flow of 566.4 m^3/s (200 cfs) is slated to be released when available (IWRB 1993).

Downstream from Milner, flows increase greatly from ground water discharge, irrigation return, and tributaries. Numerous small tributaries enter the Snake River in the Milner-to-King Hill reach. Most of these tributaries carry substantial amounts of seasonal irrigation return flow and/or ground water discharge. The four largest tributaries are Rock Creek, Salmon Falls Creek, the Malad River, and Clover Creek (Figure 1). Salmon Falls Creek is fully regulated by Salmon Falls Creek Reservoir near Rogerson. The Malad River is the largest tributary and during normal runoff years is composed entirely of irrigation returns and ground water discharge (IWRB 1993).

The largest inflow to the middle Snake River is from the many springs that come from the Snake River Plain aquifer on the north and east sides of the canyon (see Location and History for further discussion). Ground water discharge in the Milner to King Hill reach varies with changing recharge conditions (IWRB 1993). Development of ground water for irrigation on the Snake River Plain began in the mid-1940's. An increase in ground water discharge between 1902 to the early 1950's has been attributed to increased ground water recharge caused by surface water irrigation north and east of the springs. Since the mid-1950's, these recharge levels have begun to slowly decline. Withdrawals from the aquifer (pumping) and increased efficiency in irrigation practices are expected to result in a continuation of the decline (IWRB 1993). If these withdrawals are reduced to some relatively fixed level in the future, an equilibrium between inflows and upstream withdrawals may be reached in the aquifer. The highest flows in the middle Snake River occur in the fall as a result of the cumulative effects of recharge by surface water irrigation. Low flows occur in April or May before the new irrigation season recharge becomes evident.

B. Hydropower

The state relies on hydropower as its principal source of electrical energy. Private and publicly-owned utilities operate the hydroelectric system, which provides about 60% of the state's total needs (IWRB 1993).

More than half of the total elevation drop of the Snake River between Heise and Weiser occurs in the middle Snake River. The river drops 471 m (1,570 ft) between Milner Dam and King Hill, with the steepest gradient of 9.7 meters/kilometer (m/km) [32.4 feet/mile (ft/mi)] between Milner and Kimberly (IWRB 1993). Six of 63 hydroelectric dams of the Snake River Basin are located on the mainstem Snake River between Milner and King Hill; 40% of the state's hydroelectric facilities are located on the Snake River, its tributaries, or adjacent canal systems in the region. However, these 63 facilities comprise only 8% of Idaho's installed generating capacity (IWRB 1993).

Five of the mainstem hydroelectric projects on the Snake River are owned by IPC and operate as run-of-river plants with minimal reservoir storage used for daily power-peaking (load following) purposes. Additional IPC projects at Thousand Springs, Clear Lakes, and the Malad River use flows collected from springs flowing from the canyon walls. The IPC in conjunction with the Northside and Twin Falls Canal companies, have added power generating facilities at Milner Dam.

Seven additional mainstem hydroelectric projects are currently proposed for the Snake River. All 7 projects are located in areas designated as "recreational"[3] rivers, which prohibits the construction of hydropower projects, dams, or impoundments (IWRB 1993). These projects include the following:

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[3] As part of the state comprehensive water planning process, IWRB may designate selected waterways as protected rivers. "Natural" river means a waterway which possesses outstanding fish and wildlife, recreation, or aesthetic values. The construction of hydropower projects, dams, impoundments and water diversion works is prohibited. "Recreational" river has the same values but might include some substantial development within the waterway. The prohibited activities on a recreational river are determined at the time of designation.

1) Star Falls (FERC 5797) - License application has been submitted.

2) Auger Falls (FERC 4797) - License issued. (unconstructed). Although this reach of river is designated a "recreational" river, the Auger Falls project is exempt from the prohibitions of this designation.

3) Boulder Rapids (FERC 10772) - License application has been submitted.

4) Empire Rapids (FERC 10849) - License application has been submitted.

5) Kanaka Rapids (FERC 10930) - License application has been submitted.

6) A.J. Wiley (FERC 11020) - Preliminary permit issued.

7) Dike (FERC 10891) - Preliminary permit issued.

C. Aquaculture

The high quality water coming from the Snake River Plain aquifer via the natural springs makes the Hagerman area of the Snake River an excellent fish farming area. Approximately 70% of the spring flow in the Snake River is utilized for fish production. In 1991, IDFG had 98 active commercial fish culture permits on file for facilities adjacent to the Snake River or its tributaries (IWRB 1993). Four State and Federal hatcheries and about 55 private ponds in the area are also used to raise fish for private and non-commercial purposes. The primary fish species raised in these facilities are rainbow trout and channel catfish (IWRB 1993).

Waste materials that accumulate from hatchery operations include uneaten and undigested food, fecal matter, and metabolites which exist in soluble, colloidal, or suspended forms. These accumulated waste materials are removed on a periodic basis by various raceway cleaning methods. Currently, commercial aquaculture facilities are authorized by Federal permit to discharge a total of 52,875 kg (117,500 lbs) of suspended solids per day to the Snake River (IWRB 1993).

D. Domestic, Commercial, Municipal and Industrial Uses

Ground water sources supply approximately 60% of the domestic, commercial, municipal and industrial water needs in the Snake River Plain. The Snake River Plain aquifer has been designated as a "sole-source" (a "sole-source" designation recognizes the value of a source of water for drinking water) aquifer by the EPA. Thermal water is also extensively used in the Snake River Plain. Most of the thermal water is associated with known faults or fractures (IWRB 1993). The main uses of this water include resorts, freshwater aquaculture, and greenhouses (IWRB 1993). Several of the resorts and greenhouses are located along the middle Snake River near Bliss and Banbury Hot Springs, sites of the hottest thermal springs (65°C, 149°F) in the Snake River Plain.

APPENDIX D. Landmarks and associated RM/RKM along the Snake River in Idaho (Pacific Northwest River Basins Commission 1976).

LANDMARK	RKM	RM
Homedale	669.8	416.0
Grandview	783.4	486.6
C.J. Strike Dam	795.3	494.0
Loverridge Bridge (State Hwy 51)	825.9	513.0
Indian Cove Bridge	845.9	525.4
King Hill	880.0	546.6
Clover Creek	881.8	547.7
Bancroft Springs	890.3	553.0
Bliss Dam	902.1	560.3
Malad River	920.0	571.4
Hagerman	921.7	572.5
Lower Salmon Falls Dam	922.5	573.0
Upper Salmon Falls Dam	936.1	581.4
Thousand Springs	941.5	584.8
Salmon Falls Creek	944.3	586.5
Box Canyon	947.0	588.2
Banbury Springs	948.8	589.3
Kanaka Rapids	952.8	591.8
Niagara Rapids	964.4	599.0
Rock Creek	976.3	606.4
Twin Falls	982.9	610.5
Shoshone Falls	989.8	614.8
Kimberly	993.7	617.2
State Hwy 50 Bridge	999.8	621.0
Morzaugh Bridge	1015.1	630.5
Milner	1028.3	638.7
Minidoka Dam	1085.9	674.5
Raft River	1108.8	688.7
Eagle Rock Damsite	1141.5	709.0
American Falls Dam	1149.5	714.0
Blackfoot River	1208.5	750.6

APPENDIX E. List of instream flow rights currently held by the State in the middle Snake River.

SOURCE ENDING	PRIORITY DATE	FLOW IN CFS	APPLIC/ PERMIT /LIC
Vineyard Creek	09/13/78	17	L
Briggs Springs	09/13/78	56	A
Blind Canyon Springs	09/13/78	8	P
Lower White Springs	09/13/78	11	A
Banbury Springs	09/13/78	97	A
Devils Corral Springs	09/21/79	48	L
Minnie Miller Springs	03/19/86	200-450	P
Crystal Springs	07/27/87	50	P
Box Canyon Creek	10/16/87	75-162	P
Niagra Springs Creek	01/29/88	45-110	A
Crystal Springs	07/01/88	25	P
Box Canyon Creek	08/04/88	550	A
Thousand Springs AKA's Thousand Springs Estuary	08/03/90	500	P
Sculpin Springs Creek	08/03/91	33	P
Sand Springs Creek	08/03/91	34	P
Billingsley Creek	06/24/91	75-140	A
Crystal Springs	03/22/91	59	P
Niagra Springs/Niagra Creek	03/24/92	264	A
Bancroft Springs	09/13/78	17	L
Malad River	03/27/81	75	A
Malad River AKA "Big Wood"	06/19/81	39	P
Malad River	01/29/88	30-400	A
Rock Creek, East Fork	01/16/80	11	P
Rock Creek, East Fork	09/12/84	11	P
Box Canyon Creek	07/12/71	850	A
Big Springs	12/07/71	66.57	L
Niagra Springs	07/12/71	264	A
Thousand Springs	10/10/73	1500	A
Malad Canyon Springs	07/12/71	900	L
Snake River	12/29/76	3300	D
Snake River	07/01/85	600	D
Snake River	07/01/85	2300	D

APPENDIX F. Review of the Technical/Agency Review Draft of the Snake River Aquatic Species Recovery Plan

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On February 23, 1994, the Service made available for public review the Technical/Agency Draft of the Plan. The public comment period, announced in the Federal Register, extended over a 90-day period and closed on May 25, 1994. The Service solicited comments on the document from individuals and/or agencies identified below. During the comment period, the Service received 34 response letters from individuals or organizations denoted with an asterisk (*) on the list below. The comments provided in these letters were considered in preparation of the final recovery plan and incorporated as appropriate. For a copy of the Service's response to comments, contact the Service at 4696 Overland Road, Room 576, Boise, Idaho 83705.

Responses included comments from three individuals with extensive experience in gathering information on the listed snails and the middle Snake River: Terry Frest, DEXIS Consulting; Peter Bowler, University of California; and Richard Konopacky, Konopacky Environmental. The responses to their comments are available as stated above. Major issues raised by these three individuals are summarized below:

1. Recovery is not defined in terms of the species needs, i.e. population numbers, numbers of colonies, etc.

   Service Response - The final Plan identifies measurable recovery criteria based on the species' persistence in suitable habitats. If future studies provide enough information to base recovery on numbers of individuals or colonies, the final Plan may be revised to incorporate such information. The Service has added more specific recovery criteria that reflects the State's cold-water biota standards, as an interim to standards necessary for snail recovery.

2. The Draft Recovery Plan placed too much emphasis on lab-oriented means for life history or toxicity testing. More emphasis should be placed on habitat improvement and conservation of existing populations including the purchase of water rights.

   Service Response - The Final Recovery Plan gives the highest recovery task priorities to those programs focused on the protection and improvement of habitat (Figure 8) while acknowledging the need for continued research on those elements of snail biology that relate directly to determining threats and habitat needs.

3. Requested a better definition of terms such as "cold" and "slow-moving" water.

   Service Response - The term slow-moving has been removed, where appropriate stream segments are referred to as impounded or free-flowing. The term "cold-water" has been defined in the cold-water biota standards as having an average temperature below 18°C.

4. The parties expressed divergent opinions on the effectiveness of controlling non-native species.

   Service Response - The Service has changed the task wording from "eliminate" to "evaluate" the effects of non-native species. This evaluation will determine if control of non-natives is feasible or will aid in the recovery of the listed species.

5. Mollusc surveys should be expanded beyond the Snake River basin.

   Service Response - The current recovery geographical areas were selected to expedite recovery goals and be as practical as possible. Additional surveys beyond the defined recovery area will be welcome.

6. Questioned the appropriateness of including non-listed species in the Draft Recovery Plan.

   Service Response - The appropriateness of including non-listed species in the recovery plan is explained under the "What is a recovery plan?" section of this document. Activities associated with non-listed species have been given a low priority and will only be considered when the action will also benefit the listed species.

7. Concerned that habitat requirements and limiting factors have not yet been sufficiently established to justify recommendations in the draft Plan.

   Service Response - See responses for #s 1 and 2 above.

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