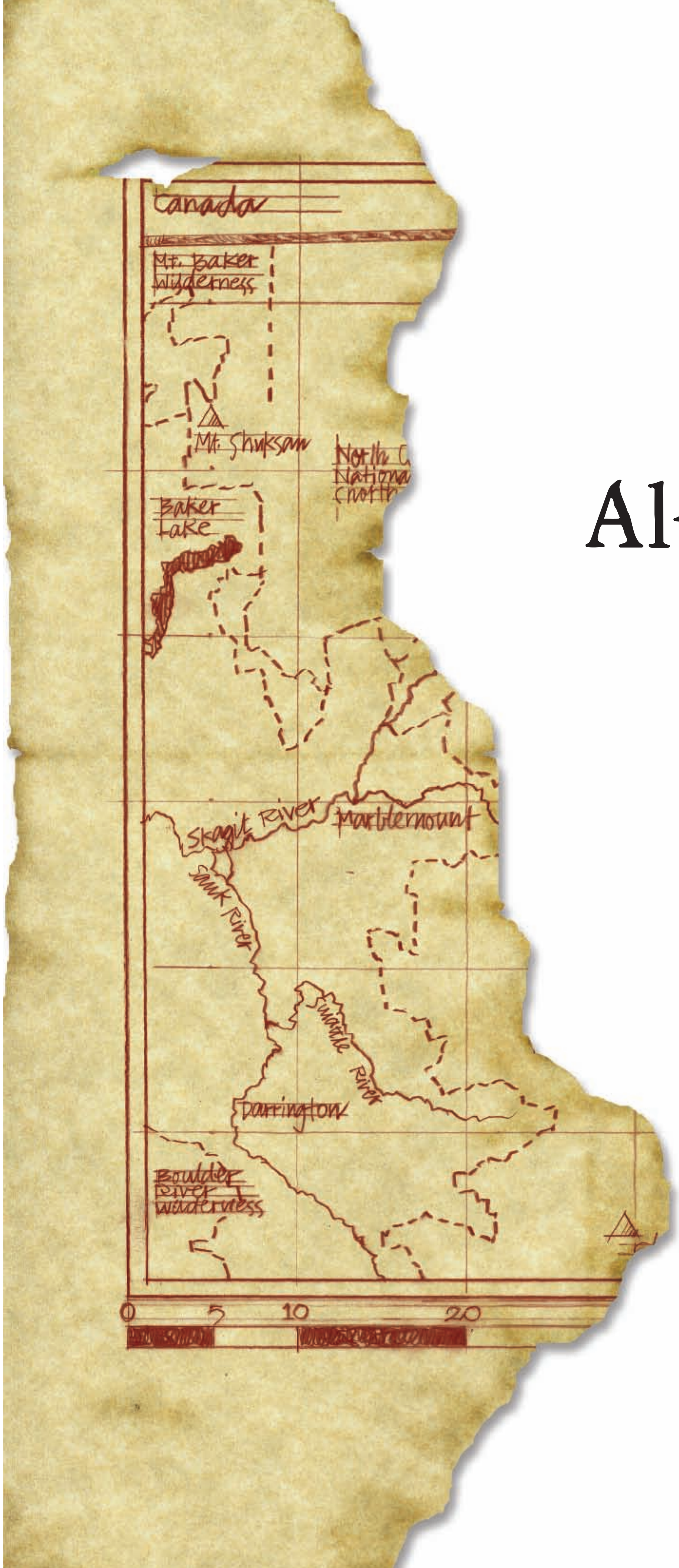


Alternatives

Welcome

You are now in the "Alternatives" chapter.
Here are the topics you can read about.

INTRODUCTION

This "Alternatives" chapter describes the various actions that could be implemented for current and future management of the mountain lakes fishery in the North Cascades National Park Service Complex (the North Cascades Complex). The *National Environmental Policy Act* (NEPA) requires that federal agencies explore a range of reasonable alternatives and provide an analysis of what impacts the alternatives could have on the natural and human environment. The "Environmental Consequences" chapter of this *Draft Mountain Lakes Fishery Management Plan / Environmental Impact Statement* (plan/EIS) presents the results of the analyses. The alternatives under consideration must include a "no-action" alternative as prescribed by 40 *Code of Federal Regulations* (CFR) 1502.14. The no-action alternative in this plan/EIS is the continuation of current management of the mountain lakes fishery, and it assumes that the National Park Service (NPS) would not make major changes to the current fishery management program. The three action alternatives presented in this chapter were derived from the recommendations of the interdisciplinary planning team and through feedback from the public during the public scoping process. The interdisciplinary planning team (also referred to as the Technical Advisory Committee) is comprised of NPS resource specialists, Washington Department of Fish and Wildlife (WDFW) biologists, and other individual resource specialists.

The three action alternatives analyzed in this plan/EIS meet, to a large degree, the management objectives for the North Cascades Complex and also the purpose of and need for action as expressed in the "Purpose of and Need for Action" chapter. Because each of the action alternatives is responsive to the objectives, they are considered "reasonable."

STUDY AREA DEFINITION

The study area for this plan/EIS is the North Cascades Complex (see “Map 1” located in the envelope that accompanied this document) and the 91 naturally formed mountain lakes in the North Cascades Complex that currently have, or at one time had, a fish presence as a result of either documented or undocumented fish stocking activities. Under natural conditions, these 91 mountain lakes would be fishless, but available records indicate these lakes have either been stocked in the past or are stocked now. The records were compiled from databases maintained by the NPS, WDFW, and volunteer groups such as the Washington State Hi-Lakers and Trail Blazers, Inc. Some lakes without a recorded history of fish stocking are included in the study area as well. These are lakes known to contain fish as a result of undocumented stocking by humans or from being connected to a lake or stream that serves as a source of fish. Two fishless lakes that have a history of fish presence (Silver and Pyramid) are in Research Natural Areas. Research Natural Areas were established in the North Cascades Complex’s 1988 *General Management Plan* (NPS 1988b) for the purposes of scientific research. A total of 245 mountain lakes are in the North Cascades Complex, and at least 154 of these lakes have always been fishless and would continue to be fishless under any alternative. Because they would remain fishless, and because they have never been part of the managed fishery, these 154 lakes are not analyzed in this plan/EIS.

The 91 lakes addressed in this plan/EIS are dotted throughout the North Cascades Complex: 7 are in Ross Lake National Recreation Area, 15 are in Lake Chelan National Recreation Area, and 69 are located in the North Cascades National Park (see “Map 1” in the envelope that accompanied this document). Of the 91 lakes in the study area, 90 lakes are located in designated wilderness (Stephen T. Mather Wilderness) that overlays approximately 93% of the North Cascades Complex.

Historically, all mountain lakes in the North Cascades Complex, including the 91 lakes defined for this analysis, were naturally fishless. The fish species currently present in these lakes are not native to the lakes in accordance with *NPS Management Policies* (NPS 2001a) that define nonnative species. However, some native fish species (native to the watershed and streams) reside in the streams connected to the lakes. For instance, species of fish, such as bull trout, cutthroat trout, and rainbow trout, are native to the streams in the study area. Notable aquatic species native to mountain lakes include the long-toed salamander, the Northwestern salamander, and certain species of planktonic organisms and macroinvertebrates because they were present naturally prior to fish stocking.

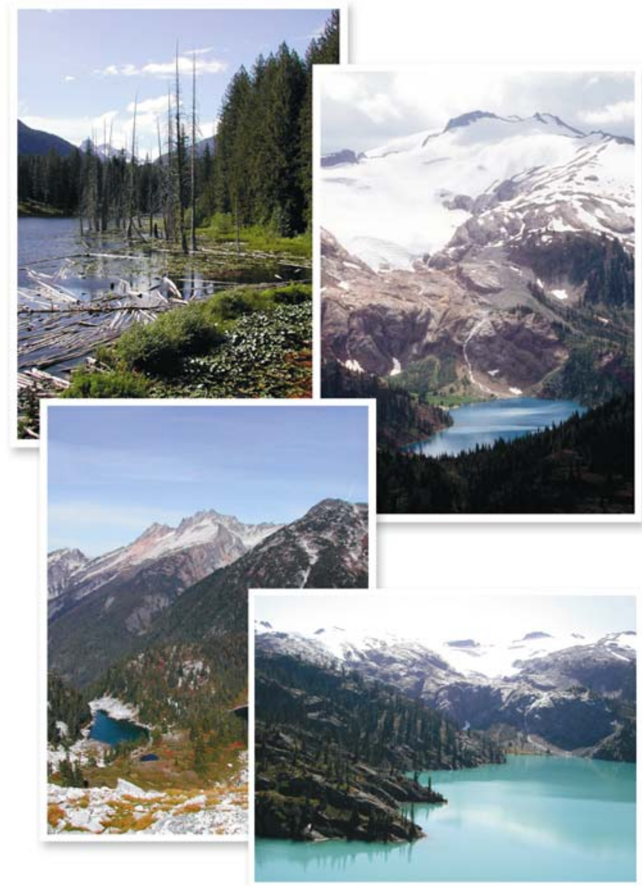
ALTERNATIVES DEVELOPMENT PROCESS

OVERVIEW OF ALTERNATIVES

The management actions are discussed in detail in this chapter under the sections titled “Development of Management Actions for Alternatives B and C” and “Management Actions.” The management actions were applied to each of the alternatives as follows:

Alternative A: No Action—Existing Management Framework of 91 Lakes (62 Lakes Have Fish). No new management actions were applied. This alternative assumes that the current management decisions, without any new criteria or factors, would continue.

Alternative B: Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative). The management actions were applied on a lake-by-lake basis over the entire study area using the approach described below in the section titled “Development of Management Actions for Alternatives B and C.” The emphasis of alternative B would be to eliminate high-density reproducing fish from study area lakes in order to more closely approximate natural biological conditions. Fish would occur in lakes where impacts on biological resources from low-density reproducing or nonreproducing fish populations could be minimized.



Green Lake, Green Lake with Bacon Peak in the background, Wilcox Lakes, and Coon Lake.

Alternative C: Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish). The goal of alternative C is that 9 lakes in Ross Lake and Lake Chelan National Recreation Areas would have fish, and 2 lakes would be evaluated for restocking. The other 11 lakes in the national recreation areas either would remain fishless or become fishless. The 69 lakes in the national park would be returned to their natural fishless condition or would remain fishless. These actions would bring high alpine lake management in the North Cascades Complex more in line with current NPS management practices. While *NPS Management Policies* (NPS 2001a, 4.4.4.1) state that in general, “exotic species will not be introduced into parks,” policies also state, “in some situations, the Park Service may stock native or exotic animals for recreational harvesting purposes, but only when . . . such stocking is in a national recreation area or preserve that has historically been stocked” (NPS 2001a, 4.4.3). Fish would be allowed in national recreation area lakes where impacts on biological resources from low-density reproducing or nonreproducing fish populations could be minimized (NPS 2001a).

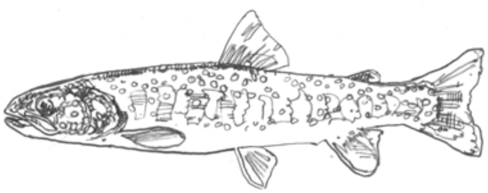
Alternative D: 91 Lakes Would Be Fishless (Environmentally Preferred Alternative). The goal is that all 91 lakes in the study area would be fishless. Fish would be eliminated (to the extent feasible) in lakes that currently contain fish, and lakes that are now fishless would remain fishless.

The following sections describe in detail how these alternatives were developed.

REVIEW OF EXISTING DATA

Biota: The combined plant and animal life of a particular region.

As described in the "Purpose of and Need for Action" chapter, preparation of this plan/EIS was to begin upon completion of a 12-year research program initiated by Oregon State University (OSU) in 1988. While the majority of research from 1988 to date focused on the effects of fish stocking on native biota in mountain lakes, other information important to fishery management has been developed during this time. Over the past several years, species of special concern and new listings of threatened and endangered species, such as the bull trout, have created the need for additional management of mountain lakes to ensure species were not being inadvertently affected by fishery management. The primary user groups of the mountain lakes fishery have also collected data important to understanding the use of this resource. Information obtained during this time has pointed to the concept of biological integrity as an overarching goal of lake management, strongly related to the reproductive status and abundance of fish in high mountain lakes.



Bull trout are native to Washington State waters and are listed as threatened under the Endangered Species Act.

Challenged with the task of synthesizing existing information, the Technical Advisory Committee developed a database that comprehensively describes each of the mountain lakes in the scope of this planning effort. A variety of records and sources were compiled and queried for each of the 91 lakes to describe, among many things, fish stocking history, fish reproduction success, chemical and biological conditions, and which lakes had an inlet or outlet leading to another lake (see appendix E for a complete description of the attributes of the lakes).

After determining the existing conditions of each lake, the Technical Advisory Committee then developed a method to characterize and sort the lakes. Characterizing the lakes provided an organizational tool used to help analyze resource impacts that could occur under each of the action alternatives described in this chapter. It was also a useful tool in gauging how each of the management alternatives met the objectives in taking action, as described in the "Purpose of and Need for Action" chapter.

APPLICATION OF RESEARCH

The 1985 Memorandum of Understanding and 1988 Supplemental Agreement, as well as the 1991 Consent Decree (see the "Purpose of and Need for Action" chapter for a discussion of these three documents and appendix A for copies), called for research that could be used to more fully understand the environmental impacts of fish stocking. This information could then be used to develop future management decisions. The primary technical challenge in preparing this plan/EIS involved applying the large body of available ecological knowledge and theory. This section provides an overview of how research results and ecological concepts were applied to

> develop management alternatives that conserve biological integrity while allowing fish to occur in some lakes
>
> describe the ecosystem functions and human values that could be potentially affected by fishery management actions
>
> evaluate the potential impacts of management alternatives on ecosystem functions and human values

The water quality parameter total Kjeldahl nitrogen, or TKN, is a surrogate measure for lake productivity. See appendix F for a detailed description of TKN.

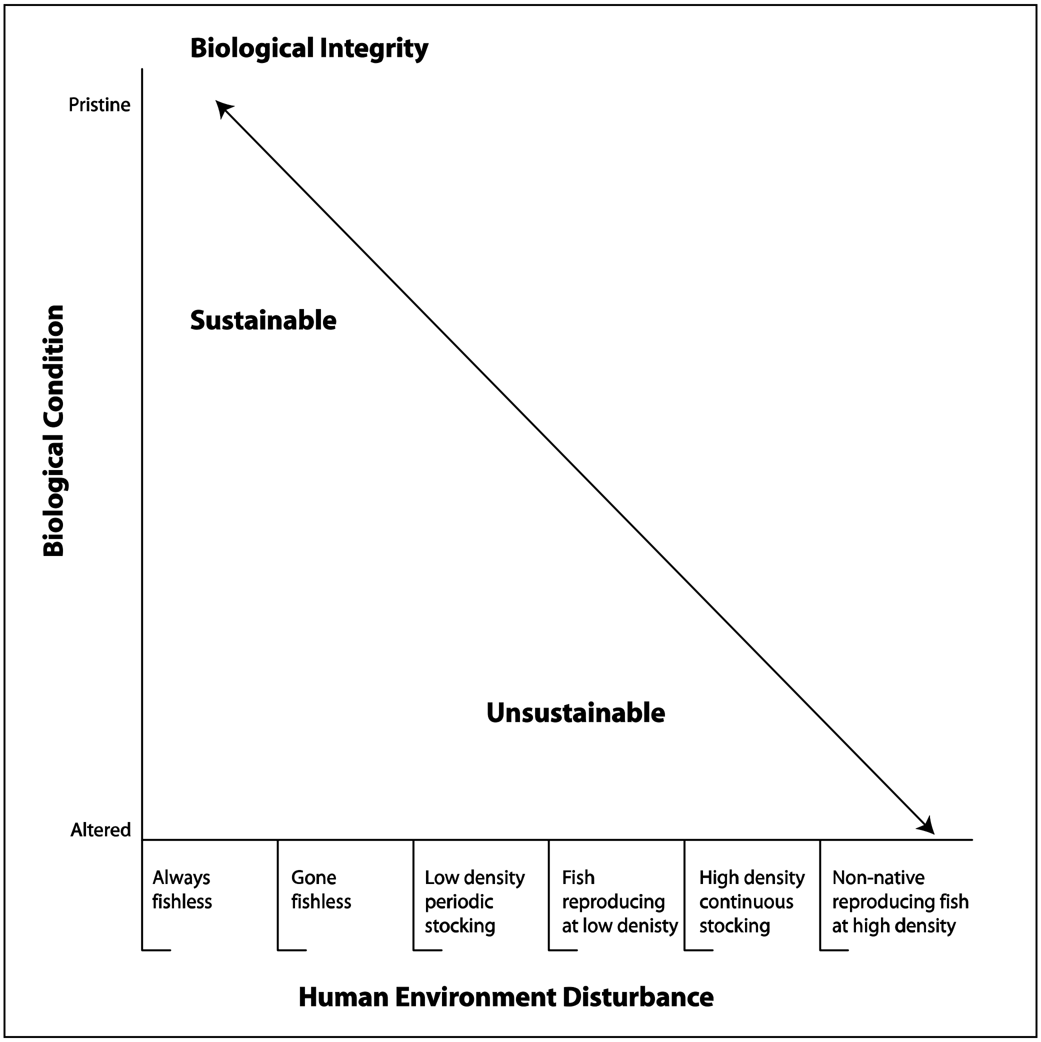
The "Environmental Consequences" chapter provides further details of how research was used to formulate management actions and evaluate their effects. The Technical Advisory Committee for this plan/EIS adopted the following common definition of biological integrity:

> The capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region (Karr and Dudley 1981).

To relate the purpose of "conserving biological integrity" to mountain lakes fishery management, the Technical Advisory Committee drew upon the principal conclusions of the OSU research, including the ecological effects of nonnative trout are related to the reproductive status and abundance of trout in lakes. The Technical Advisory Committee interpreted this finding to mean that lakes with the lowest degree of biological integrity (or greatest departure from biological integrity or pristine conditions) contained reproducing populations of nonnative trout or char that had achieved high densities. On the other end of the biological integrity spectrum, the Technical Advisory Committee assumed mountain lakes that had never been stocked represented the highest degree of biological integrity. By taking the general concept of biological integrity and defining it in the context of this plan/EIS, this approach allowed the Technical Advisory Committee to formulate a conceptual framework for "conserving biological integrity" by relating how the reproductive status and abundance of nonnative trout influenced the biological integrity of the mountain lakes (see figure 3). This conceptual framework was used to craft management alternatives B and C based on the hypothesis that the biological integrity of mountain lakes could potentially be conserved by managing for nonreproducing trout at low densities in some lakes and managing for fishless conditions in other lakes.

The OSU research recommended that "a prudent and precautionary management strategy would be to maximize protection of all North Cascades Complex lakes with relatively high total Kjeldahl nitrogen (TKN)" (Liss et al. 2002). In other words, the concentration of TKN could be used as one criterion for selecting lakes for stocking and for fish removal. Productive lakes (those with relatively high TKN) should remain fishless to provide productive habitat for native species, particularly amphibians.

FIGURE 3: MANAGEMENT MODEL FOR CONSERVING BIOLOGICAL INTEGRITY IN MOUNTAIN LAKES



Note: This figure illustrates the application of a conceptual biological integrity model (based on Karr 2000) to disturbance associated with various states of nonnative fish presence in naturally fishless mountain lakes (Downen 2004). The model illustrates a theoretical relationship between the reproductive status and abundance of nonnative trout and their impact on the biological condition or integrity of mountain lakes. When considered in the context of fisheries management, lakes that have always been fishless are believed to have the highest degree of biological integrity. In contrast, lakes that have high densities of reproducing trout are believed to have the lowest degree of biological integrity, as demonstrated by the OSU research findings. Alternatives B and C were developed based on the biological integrity model hypothesis that fishery management actions could conserve biological integrity by (a) preventing stocking of currently fishless lakes; (b) removing reproducing populations of fish where feasible; and (c) stocking low densities of nonreproducing fish in select lakes according to the management principles described in table 2. Removal of reproducing fish populations (especially at high densities) from lakes was also proposed as an element common to all action alternatives (WDFW 2003).

The Technical Advisory Committee initially attempted to adopt the OSU research recommendation as a means of selecting lakes to be fishless based on impacts of trout. However, this was abandoned out of concern for (a) making biologically based decisions centered on a threshold concentration of a single water-quality parameter and (b) only protecting one class of ecosystem type rather than maintaining a diversity of fishless ecosystems. Instead, the Technical Advisory Committee considered TKN as part of a suite of physical, chemical, biological, and spatial criteria for determining what lakes could be stocked and what lakes should remain fishless. This more complex decision-making process accommodated the results of other research (for example, impacts on native fish that can occur when nonnative trout migrate downstream from lakes) and aided in the consideration of impacts on native organisms at multiple biological scales (organism, species, community) and spatial scales (within a lake, lake clusters, watersheds).

In contrast to alternatives B and C, alternative D (91 Lakes Would Be Fishless) was crafted to meet the spirit and intent of NPS policies by discontinuing stocking and eventually removing reproducing populations of fish from mountain lakes wherever feasible. This management alternative was not based specifically upon a research finding related to the ecological effects of nonnative fish in North Cascades Complex lakes. Instead, alternative D was developed because it most closely achieved the spirit and intent of NPS policies regarding management of nonnative species. These policies are based upon the wide body of scientific evidence that nonnative species can have broad impacts on ecosystem functions and values. Alternative D also provides a basis for comparing the effects of the no-action alternative (alternative A) and the other action alternatives.

Adaptive management incorporates monitoring and research into conservation actions. Specifically, it is the integration of planning, management, and monitoring to test assumptions in order to adapt and learn.

Alternative D emphasizes conservation of biological integrity by establishing a goal of completely removing nonnative fish from lakes in the North Cascades Complex. Researchers and resource managers have attempted to remove trout from mountain lakes in the western United States and Canada, and results have been mixed. These results demonstrate that complete removal may not be achieved in all lakes containing reproducing fish. Nine lakes have been identified where complete removal may not be feasible. Alternative D meets all of the management objectives to a large degree, with the exception of offering a diversity of recreational opportunities, including sport fishing. However, fishing opportunities would continue to be available in the foreseeable future while fish removal activities are completed. In addition, fishing opportunities would still remain in the reservoirs, rivers, and some streams throughout the North Cascades Complex.

The Technical Advisory Committee recognized that each management alternative was developed with scientific information and data that are provisional and possibly incorrect. In light of this uncertainty, the Technical Advisory Committee included the principle of adaptive management as an element common to all action alternatives. Adaptive management "focuses on management as a learning process or continuous experiment where incorporating the results of previous actions allows managers to remain flexible and adapt to uncertainty" (Grumbine 1994). The Technical Advisory Committee incorporated the principle of adaptive management into each of the management alternatives by developing a lake monitoring plan (see appendix F) to evaluate management actions and create a mechanism for changing those actions if management goals were not being achieved.

The “Affected Environment” chapter of this plan/EIS describes the resources and values that could potentially be affected by fishery management actions. The OSU research generated a large amount of physical, chemical, and biological baseline data on mountain lakes in the North Cascades Complex. The Technical Advisory Committee used these data, along with information from other research and monitoring efforts by the NPS, WDFW, and Trail Blazers, to build a comprehensive database on mountain lakes in the North Cascades Complex. This database, largely derived from past and ongoing research activities, was used to help understand and describe the resources and values that could be affected by fishery management actions.

The OSU research largely evaluated the ecological effects of nonnative trout on aquatic organisms at the scale of individual lakes. To understand the potential effects of nonnative fish at broader scales, including the potential impacts from downstream dispersal, information from other research and monitoring efforts was also extensively used. In the Stehekin River drainage, for example, ongoing research into hybridization between native westslope cutthroat trout and nonnative rainbow trout was used to evaluate the potential impacts of fishery management actions in the drainage. On the west side of the North Cascades Complex, bull trout research and monitoring data were used in a similar fashion.

In summary, this plan/EIS was initiated upon completion of the OSU research into the ecological effects of nonnative trout because the research provided a critical mass of information. The OSU research contributed greatly to the formation of management alternatives and the impact analysis process; however, the results of many other research efforts were used to craft the management alternatives and evaluate impacts. More thorough descriptions on the role of research are provided in the “Environmental Consequences” chapter. The use of research results, including widely accepted ecological principles, helped to achieve the stated objective of ensuring that decisions would be made in accordance with the best available science.

DEVELOPMENT OF MANAGEMENT ACTIONS FOR ALTERNATIVES B AND C

Various decision-making criteria emerged during the process of reviewing research. These refined criteria (ecological risk factors) are described in table 1. The Technical Advisory Committee reviewed the conditions of each lake and applied the factors in table 1. Then, the principles in table 2 were used to determine the management action for each lake.

Table 3 shows how the ecological risk factors and principles were assigned to each lake. A more detailed discussion of how these principles would be applied to determine final management actions for each lake can be found in the descriptions of each alternative later in this chapter.

TABLE 1: ECOLOGICAL RISK FACTORS FOR NEW MANAGEMENT FRAMEWORK

Fishless conditions currently present	Is the lake currently fishless? This suggests that protecting currently fishless (though historically stocked) lakes is biologically beneficial because the lakes are slowly reverting to pre-stocking conditions, and there is no compelling reason to alter that process.
Unique lake features or circumstances	Does the lake posses any unique features or circumstances that would favor fishless conditions, such as **Geographic Isolation**: Is the lake isolated from other water bodies that serve as a refuge or breeding habitat for the long-toed salamander? Isolated lakes may be very important for protecting isolated populations of salamanders, especially if the surrounding habitat consists of shallow ponds or wetlands that could dry up or be otherwise impacted by random natural events. This risk factor acknowledges that isolated populations of native species, such as long-toed salamanders that are slow to disperse, must be sufficiently distributed across the landscape to ensure their long-term sustainability. Consideration of geographic isolation helps to ensure that metapopulations of such amphibian species are adequately protected at the broadest spatial scales. **Species of Conservation Concern**: Do rare or unique species (such as the blind amphipod) reside in the lake? Blind amphipods are found in at least two park lakes and may be in other lakes that have not been sampled. Amphipods are a type of macroinvertebrate that can be an important food source for fish and could be inadvertently lost due to predation. Should other organisms of conservation concern be found through monitoring, fishery management actions would be adjusted to prevent harm. Could species of special concern (such as the bull trout) be affected by the presence of nonnative fish in lakes? Native fish species that reside in streams could potentially be affected through hybridization and competition by nonnative fish escaping from lakes into streams. **Under-represented Lake Type**: Is the lake large and deep or geologically unique? These lakes are often candidates for stocking, and most of the large lakes in the park have traditionally been stocked. Therefore, it is necessary to establish a representative number of large, deep lakes as fishless in order to protect the unique aquatic organisms that may prefer this type of lake.
Capacity to serve as suitable habitat for, and within the range of, long-toed salamanders	Does the lake have the appropriate physical habitat and biological productivity to produce and maintain source populations of long-toed salamanders? Long-toed salamanders are biological indicators of an unsustainable fish density because they are particularly sensitive to fish predation. Since the long-toed salamander is more sensitive than most other amphibians to fish predation, protecting habitat for long-toed salamanders helps to prevent elimination of in-lake populations and protect overall health of amphibians in the North Cascades Complex. This criterion recognizes that lakes in the North Cascades Complex vary widely in habitat quality for salamanders. The physical, chemical, and biological characteristics of lakes make some more suitable than others for nurturing genetically sustainable populations of long-toed salamanders. Populations of long-toed salamanders in lakes that provide high-quality habitat can withstand the impacts of disturbance (such as drought) and, presumably, recolonize the surrounding watershed following disturbance. Long-toed salamanders are only able to reproduce in large numbers in lakes that provide high-quality habitat. In addition to reproduction, their offspring must be able to survive in numbers that are sufficient for ensuring long-term genetic diversity. To meet this criterion, the lake must also be located in what is considered the geographic range of the long-toed salamander.
Shared lake conditions exist between the long-toed salamander and fish	Does evidence suggest that a lake can maintain fish populations while allowing salamanders to coexist? Situations have been observed in lakes where both fish and salamander populations exist. It is assumed that these lakes possess special features such as shallow habitat, large amounts of woody debris, or a complex shoreline configuration that protects salamanders from fish predation.
Presence of high density of reproducing fish	Have stocked fish reproduced and overpopulated the lake? High densities of fish have the ability to deplete their food base and cause measurable declines and, in some cases, disappearance of native aquatic species. This factor seeks to identify lakes that should be considered and prioritized for fish removal.
Macroinvertebrate populations are suppressed	Are macroinvertebrate populations within a lake suppressed? Certain taxa of macroinvertebrates are sensitive to fish predation. Macroinvertebrates, like amphibians, are good indicators of ecosystem health and the effect fish have on the ecosystem. Currently, limited data are available for this criterion, but it is an important factor.
Lake grouping	Is the lake a part of a unique grouping where at least one of the lakes should be established as fishless? In certain areas, several lakes are located in relatively close proximity (e.g., Hozomeen, Willow, and Ridley lakes). Management actions for these lakes need to be considered collectively. This criterion suggests that at least one lake in a grouping of lakes in a unique geographical location or physical circumstance should be maintained as fishless in order for natural conditions to exist. This concept allows for a wide diversity of lake types to be represented in a fishless state. Lakes that contain fish and are in relatively close proximity to one another were considered collectively, and management actions were tailored to minimize the potential impacts to metapopulations of salamanders in these lake groupings.
Lack of Information	Data is lacking for some lakes. This factor acknowledges uncertainty and the need for gathering additional information before taking management actions.

TABLE 2: PRINCIPLES FOR MANAGING THE MOUNTAIN LAKES FISHERY TO CONSERVE BIOLOGICAL INTEGRITY

1.	A prudent and precautionary management strategy should protect all lakes that are currently fishless. A lake that is fishless today would remain fishless in the future.
2.	Reproducing populations of fish that have achieved high densities would be removed from all lakes where feasible. Following removal, the biological conditions of the lakes would be monitored for recovery. Monitoring results would be used to decide whether or not the lake could be stocked with low densities of nonreproducing fish.
3.	Lakes that serve as high-quality breeding and rearing habitat for amphibians and are located within the range of long-toed salamanders, generally would be returned to a fishless condition, or low densities of nonreproducing fish would be allowed if no other criteria applied. However, observations indicate that certain lakes have complex habitat conditions, such as extensive shallow areas and woody debris, which would allow amphibian populations to persist in spite of fish predation or competition. Where a lake has a long history of stocking and salamanders are known to exist sympatrically (together in the same area; for example, Coon Lake), nonreproducing fish would be stocked at low densities.
4.	Certain lakes would be managed as fishless due to unique features. These features include the presence of a species of conservation concern; large, deep lakes in fishless conditions (which are underrepresented in the North Cascades Complex); geologically unique lakes; and geographically isolated lakes. Geographically isolated lakes need to remain fishless to protect metapopulations of salamanders. A lake was considered isolated if (1) it was more than 2,000 feet from other permanent water bodies, (2) it was within the range of long-toed salamanders, and (3) there was no evidence that salamanders and fish could survive sympatrically. Lakes that possessed these unique features were considered on a larger landscape scale to determine if fishless conditions were represented among these lake types. A lake that belonged to an underrepresented type in the study area would be returned to a fishless condition.
5.	Benthic (bottom dwelling) macroinvertebrate monitoring data (collected through the NPS long-term ecological monitoring program) indicate that certain lakes have suppressed populations of macroinvertebrates. A lake with suppressed populations of macroinvertebrates would become fishless or would be evaluated further before determining final management action.
6.	In closely grouped lakes, fishless conditions in at least one lake would be maintained to provide fishless habitat for aquatic organisms in the localized area.
7.	Where key information for a given lake was lacking for this stage of planning, the lake would be evaluated before management actions would be recommended.
8.	Lakes that do not possess any of the identified risk factors (decision criteria) would be considered for stocking to maintain fish densities commensurate with the protection of biological integrity.

TABLE 3: DECISION CRITERIA FOR MANAGEMENT ACTIONS

Lake Name and NPS Lake Code	Ecological Risk Factor								
	Lack of Data[a]	Presence of reproducing fish (x = at high densities)	Fishless conditions currently present in lake	Capacity to serve as high-quality breeding and rearing habitat for amphibians and with in the range of long-toed salamanders	Presence of long-toed salamanders	The lake possesses unique features or circumstances that would favor fishless conditions (isolated lake, species of conservation concern present, large/deep lakes, geologically unique lakes)	The lake is part of a lake grouping where fishless conditions should be represented	Macroinvertebrate populations known to be suppressed	Principle for Determining Management Action[b]
Azure MP-09-01			X						Principle 1 applies
Battalion MLY-02-01	X	X		X					Principle 2 applies; principle 3 may apply
Bear MC-12-1		X					F		Principles 2 and 8 apply
Berdeen M-08-01		X					A		Principles 2 and 8 apply
Berdeen, Lower M-07-01		X		X	X		A		Principles 2 and 3 apply
Berdeen, Upper M-09-01		X					A		Principles 2 and 6 apply
Blum (Largest/ Middle, No. 3) M-11-01	X	X		X			B		Principle 2 applies; principle 3 may apply
Blum (Lower/ West, No. 4) LS-07-01		X		X			B		Principles 2 and 6 apply
Blum (Small/ North, No. 2) MC-01-01			X	X	X		B		Principle 1 applies
Blum (Vista/Northwest, No. 1) MC-02-01			X	X	X		B		Principle 1 applies
Bouck, Lower DD-04-01		X					C		Principles 2 and 8 apply
Bouck, Upper DD-05-01				X	X		C		Principle 6 applies
Bowan MR-12-01				X	X	X			Principle 4 applies
Coon MM-10-01				X	X				Principle 3 applies

TABLE 3: DECISION CRITERIA FOR MANAGEMENT ACTIONS (CONTINUED)

Lake Name and NPS Lake Code	Ecological Risk Factor								Principle for Determining Management Action[b]
	Lack of Data[a]	Presence of reproducing fish (x = at high densities)	Fishless conditions currently present in lake	Capacity to serve as high-quality breeding and rearing habitat for amphibians and with in the range of long-toed salamanders	Presence of long-toed salamanders	The lake possesses unique features or circumstances that would favor fishless conditions (isolated lake, species of conservation concern present, large/deep lakes, geologically unique lakes)	The lake is part of a lake grouping where fishless conditions should be represented	Macroinvertebrate populations known to be suppressed	
Copper[c] MC-06-01	X			X	X		F		Principle 3 applies; principle 1 may apply
Dagger MR-04-01	X	X		X					Principle 2 applies; principle 3 may apply
Dee Dee / Tamarack, Lower MR-15-02				X			G		Principle 6 applies
Dee Dee, Upper MR-15-01	X	X		X			G		Principle 6 applies
Despair, Lower M-14-01			X						Principle 1 applies
Despair, Upper M-13-01			X						Principle 1 applies
Diobsud No. 1, separate, not connected LS-01-01		X		X	X		M		Principles 2 and 6 apply
Diobsud No. 2, Lower LS-02-01	X	X		X	X		M		Principles 2 and 3 apply
Diobsud No. 3, Upper LS-03-01				X	X	X		X	Principles 4 and 5 apply
Doubtful CP-01-01		X							Principles 2 and 8 apply
Doug's Tarn M-21-01		X							Principles 2 and 8 apply
East, Lower MC-14-02			X						Principle 1 applies
East, Upper MC-14-01			X			X			Principle 1 applies
Firn MP-02-01	X								Principle 8 applies

TABLE 3: DECISION CRITERIA FOR MANAGEMENT ACTIONS (CONTINUED)

Lake Name and NPS Lake Code	Ecological Risk Factor: Lack of Data[a]	Presence of reproducing fish (x = at high densities)	Fishless conditions currently present in lake	Capacity to serve as high-quality breeding and rearing habitat for amphibians and with in the range of long-toed salamanders	Presence of long-toed salamanders	The lake possesses unique features or circumstances that would favor fishless conditions (isolated lake, species of conservation concern present, large/deep lakes, geologically unique lakes)	The lake is part of a lake grouping where fishless conditions should be represented	Macroinvertebrate populations known to be suppressed	Principle for Determining Management Action[b]
Green M-04-01	X	X		X					Principle 2 applies; principle 3 may apply
Green Bench LS-04-01			X						Principle 1 applies
Hanging MC-08-01		X		X		X			Principles 2 and 4 apply
Hidden SB-01-01							H		Principle 8 applies
Hidden Lake Tarn EP-14-01							H		Principle 6 applies
Hi-Yu M-01-01	X			X	X	X		X	Principles 4 and 5 apply
Hozomeen HM-02-01		X				X	E		Principles 2 and 4 apply
Ipsoot LS-06-01	X			X	X				Principle 3 applies
Jeanita DD-01-01	X			X	X				Principle 3 applies
Kettling MR-05-01		X		X	X	X			Principles 2 and 4 apply
Kwahnesum MC-07-01				X	X	X			Principle 4 applies
McAlester MR-10-01	X	X		X	X				Principle 3 applies; principle 2 may apply
Middle, Lower MC-16-02			X						Principle 1 applies
Middle, Upper MC-16-01			X						Principle 1 applies
Monogram M-23-01		X		X	X		I		Principles 2 and 3 apply

TABLE 3: DECISION CRITERIA FOR MANAGEMENT ACTIONS (CONTINUED)

Lake Name and NPS Lake Code	Ecological Risk Factor: Lack of Data[a]	Presence of reproducing fish (x = at high densities)	Fishless conditions currently present in lake	Capacity to serve as high-quality breeding and rearing habitat for amphibians and with in the range of long-toed salamanders	Presence of long-toed salamanders	The lake possesses unique features or circumstances that would favor fishless conditions (isolated lake, species of conservation concern present, large/deep lakes, geologically unique lakes)	The lake is part of a lake grouping where fishless conditions should be represented	Macroinvertebrate populations known to be suppressed	Principle for Determining Management Action[b]
Monogram Tarn M-23-11				X		X	I		Principle 4 applies
Nert M-05-01				X	X	X			Principle 4 applies
Noisy Creek, Upper LS-14-01			X						Principle 1 applies
No Name PM-01-01									Principle 8 applies
Panther Potholes, Lower RD-05-02									Principle 3 applies
Panther Potholes, Upper RD-05-01			X						Principle 1 applies
Pegasus EP-10-01			X						Principle 1 applies
Pond SE of Kettling Lakes MR-09-01				X	X				Principle 3 applies
Quill, Lower M-24-02	X			X			J		Principle 2 applies; principle 3 may apply
Quill, Upper M-24-01	X			X			J		Principles 3 and 6 apply
Rainbow MR-14-01		X		X	X		D		Principles 2 and 3 apply
Rainbow, Upper (North) MR-13-01			X	X	X		D		Principle 1 applies
Rainbow, Upper (South) MR-13-02				X	X		D		Principle 6 applies
Rainbow, Upper (West) MM-11-01							D		Principle 6 applies
Redoubt MC-11-01			X			X			Principle 1 applies

TABLE 3: DECISION CRITERIA FOR MANAGEMENT ACTIONS (CONTINUED)

Lake Name and NPS Lake Code	Ecological Risk Factor: Lack of Data[a]	Presence of reproducing fish (x = at high densities)	Fishless conditions currently present in lake	Capacity to serve as high-quality breeding and rearing habitat for amphibians and with in the range of long-toed salamanders	Presence of long-toed salamanders	The lake possesses unique features or circumstances that would favor fishless conditions (isolated lake, species of conservation concern present, large/deep lakes, geologically unique lakes)	The lake is part of a lake grouping where fishless conditions should be represented	Macroinvertebrate populations known to be suppressed	Principle for Determining Management Action[b]
Reveille, Lower MC-21-02			X						Principle 1 applies
Reveille, Upper MC-21-01			X						Principle 1 applies
Ridley HM-03-01							E		Principle 8 applies
Sky EP-13-01			X						Principle 1 applies
Skymo PM-03-01		X		X					Principle 3 applies
Sourdough PM-12-01	X	X		X					Principle 2 applies; principle 3 may apply
Sourpuss ML-01-01			X						Principle 1 applies
Stiletto MR-01-01	X							X	Principles 4 and 5 apply
Stout EP-09-02	X								Principle 8 applies
Stout, Lower EP-09-01	X								Principle 8 applies
Sweet Pea ML-02-01									Principle 8 applies
Talus Tarn M-06-01			X	X	X				Principle 1 applies
Tapto, Lower MC-17-03			X						Principle 1 applies
Tapto, Middle MC-17-02			X						Principle 1 applies
Tapto, Upper MC-17-01			X						Principle 1 applies

TABLE 3: DECISION CRITERIA FOR MANAGEMENT ACTIONS (CONTINUED)

Lake Name and NPS Lake Code	Ecological Risk Factor: Lack of Data[a]	Presence of reproducing fish (x = at high densities)	Fishless conditions currently present in lake	Capacity to serve as high-quality breeding and rearing habitat for amphibians and with in the range of long-toed salamanders	Presence of long-toed salamanders	The lake possesses unique features or circumstances that would favor fishless conditions (isolated lake, species of conservation concern present, large/deep lakes, geologically unique lakes)	The lake is part of a lake grouping where fishless conditions should be represented	Macroinvertebrate populations known to be suppressed	Principle for Determining Management Action[b]
Tapto, West MC-17-04			X						Principle 1 applies
Thornton, Lower M-20-01				X	X				Principle 3 applies
Thornton, Middle M-19-01									Principle 8 applies
Thunder RD-02-01			X						Principle 1 applies
Tiny MC-15-01			X						Principle 1 applies
Torment ML-03-01						X		X	Principles 4 and 5 apply
Trapper GM-01-01	X								Principle 8 applies
Triplet, Lower SM-02-01		X		X			K		Principles 2 and 6 apply
Triplet, Upper SM-02-02		X					K		Principles 2 and 6 apply
Triumph M-17-01				X	X				Principle 3 applies
Unnamed/ FP-01-01			X						Principle 1 applies
Unnamed MR-11-01				X	X				Principle 3 applies
Unnamed MR-16-01	X			X	X				Principle 3 applies
Vulcan ML-04-01			X						Principle 1 applies
Wilcox/Lillie, Upper EP-06-01		X					L		Principles 2 and 6 apply

TABLE 3: DECISION CRITERIA FOR MANAGEMENT ACTIONS (CONTINUED)

Lake Name and NPS Lake Code	Ecological Risk Factor								Principle for Determining Management Action[b]
	Lack of Data[a]	Presence of reproducing fish (x = at high densities)	Fishless conditions currently present in lake	Capacity to serve as high-quality breeding and rearing habitat for amphibians and with in the range of long-toed salamanders	Presence of long-toed salamanders	The lake possesses unique features or circumstances that would favor fishless conditions (isolated lake, species of conservation concern present, large/deep lakes, geologically unique lakes)	The lake is part of a lake grouping where fishless conditions should be represented	Macroinvertebrate populations known to be suppressed	
Wilcox/Sandie, Lower EP-05-01		X					L		Principles 2 and 8 apply
Wild MC-27-01			X						Principle 1 applies
Willow HM-04-01							E		Principle 8 applies

Lake Groupings

A. Berdeen; Berdeen, Lower; Berdeen, Upper

B. Blum (Largest/Middle, No. 3); Blum (Lower/West, No. 4); Blum (Small/North, No. 2); Blum (Vista/Northwest, No. 1)

C. Bouck, Lower; Bouck, Upper

D. Rainbow; Rainbow, Upper (North); Rainbow, Upper (South); Rainbow, Upper (West)

E. Hozomeen; Ridley; Willow

F. Bear; Copper

G. Dee Dee, Upper; Dee Dee / Tamarack, Lower

H. Hidden; Hidden Lake Tarn

I. Monogram; Monogram Tarn

J. Quill, Lower; Quill, Upper

K. Triplet, Lower; Triplet, Upper

L. Wilcox/Lillie, Upper; Wilcox/Sandie, Lower

M. Diobsud No. 1, separate, not connected; Diobsud No. 2, Lower

Notes:

a. “Lack of Data” indicates lakes where data would have to be obtained prior to taking management actions.

b. Refer to table 2 in this “Alternatives” chapter for descriptions of the principles.

c. In August 2004, a large fish kill was observed in Copper Lake, possibly due to disease. Further surveys are needed to confirm that the lake is fishless.

MANAGEMENT ACTIONS

Standard management actions were developed and applied to a differing subset of lakes in alternatives B and C according to the principles described in table 2. Where data are missing, the management action includes an evaluation element that would require more information to be collected prior to determining the management action. The standardized adaptive management actions shown in table 4 emerged from this process.

A lake-by-lake application of the management actions is in table 5. These standard management actions may not be rigidly adhered to indefinitely. All management actions would be applied according to the principles of adaptive management. Table 6 lists the 62 lakes in the North Cascades Complex managed by the WDFW that are known to contain fish; the reproducing fish species currently present in 35 of these lakes; and the species, strains, densities, and stocking cycles of fish to be stocked under the proposed new management frameworks for alternatives B and C. Stocking information for alternative A is also shown in this table.

A summary of the adaptive management concept can be found in this chapter under "Elements Common to All Action Alternatives" in the "Adaptive Management" section.

TABLE 4: DESCRIPTION OF MANAGEMENT ACTIONS

This table presents a standard set of fishery management actions for implementation under alternatives B and C. Note that management actions under alternative A would not change from current management, and management actions under alternative D only involve stopping stocking and removing all fish. The standard management actions in this table are broken down into classes 1-4, based on the Technical Advisory Committee's current understanding of the presence, reproductive status, and density of fish in the lakes. These standard management actions would require periodic monitoring and evaluation to facilitate adaptive management.	
For a lake that is currently fishless:	
1	The lake would remain fishless.
For a lake with high densities of reproducing fish, apply one of the following management actions:	
2A	Remove all reproducing fish. Monitor the recovery of native organisms and keep the lake fishless.
2B	Remove all reproducing fish. Monitor lake conditions and use the results to determine whether or not to restock the lake with nonreproducing fish. If the lake is restocked and monitoring results indicate fish are causing major adverse impacts, then fish densities would be reduced by changing stocking densities, stocking cycles, or the species of stocked fish. If these management changes do not work, then discontinue stocking (see "Appendix F: Proposed Monitoring Plan for the Mountain Lakes Fishery Management Plan" for more information on adaptive management).
2C	Remove all reproducing fish. Implement a resting period (that is, keep the lake fishless for a period of time) to foster recovery of native organisms. The duration of the resting period will be determined on a lake-by-lake basis based upon monitoring results. If monitoring results indicate favorable recovery of native organisms, then restock the lake with low densities of nonreproducing fish and monitor lake conditions. If monitoring results indicate fish are causing major adverse impacts, then reduce stocking densities, stocking cycles, or the species of stocked fish. If these management changes do not work, then discontinue stocking (see "Appendix F: Proposed Monitoring Plan for the Mountain Lakes Fishery Management Plan" for more information on adaptive management).
For a lake with low densities of reproducing fish, apply one of the following management actions:	
3A	Remove all reproducing fish. Monitor the recovery of native organisms, and keep the lake fishless.
3B	Evaluate the reproductive status of fish and the status of indicator taxa. If fish density is high enough that impacts on indicator taxa may be major, apply prescription 2A, 2B, or 2C. If fish densities and impacts to indicator taxa are low, maintain the low fish densities. If monitoring data indicate fish are causing major adverse impacts, then completely remove fish (see "Appendix F: Proposed Monitoring Plan for the Mountain Lakes Fishery Management Plan" for more information on adaptive management).
3C	For lakes with extremely low densities of fish, augment the population with supplemental stocking and monitor indicator taxa. If monitoring results indicate fish are causing major adverse impacts, then stop stocking and remove all fish (see "Appendix F: Proposed Monitoring Plan for the Mountain Lakes Fishery Management Plan" for more information on adaptive management).
For a lake that has been stocked and does not contain a reproducing population of fish, apply one of the following management actions:	
4A	Discontinue stocking. Monitor the recovery of native organisms.
4B	Lack of data for decision-making. Discontinue stocking and monitor lake conditions. If the lake is restocked and monitoring results indicate fish are causing major adverse impacts, then discontinue stocking (see "Appendix F: Proposed Monitoring Plan for the Mountain Lakes Fishery Management Plan" for more information on adaptive management).
4C	Continue stocking with low densities of fish expected not to reproduce in the lake. If monitoring results indicate fish are causing major adverse impacts, then reduce stocking densities, stocking cycles, or the species of stocked fish. If these management changes do not work, then discontinue stocking (see "Appendix F: Proposed Monitoring Plan for the Mountain Lakes Fishery Management Plan" for more information on adaptive management).

TABLE 5: MANAGEMENT ACTIONS FOR EACH OF THE 91 LAKES

Note: The shaded rows indicate the 22 lakes that are in Ross Lake and Lake Chelan National Recreation Areas; the other 69 lakes are in the national park portion of the North Cascades Complex.

Lake Name	NPS Lake Code	Current Condition of Lake (as represented under alternative A)	Management Action		
			Alternative B	Alternative C	Alternative D
Azure	MP-09-01	Fishless	1	1	1
Battalion	MLY-02-01	High density reproducing fish	2B	2B	2A
Bear	MC-12-1	High density reproducing fish	2C	2A	2A
Berdeen	M-08-01	High density reproducing fish	2C	2A	2A
Berdeen, Lower	M-07-01	High density reproducing fish	2A	2A	2A
Berdeen, Upper	M-09-01	High density reproducing fish	2A	2A	2A
Blum (Largest/Middle, No. 3)	M-11-01	High density reproducing fish	2B	2A	2A
Blum (Lower/West, No. 4)	LS-07-01	High density reproducing fish	2C	2A	2A
Blum (Small/North, No. 2)	MC-01-01	Fishless	1	1	1
Blum (Vista/Northwest, No. 1)	MC-02-01	Fishless	1	1	1
Bouck, Lower	DD-04-01	High density reproducing fish	2C	2C	2A
Bouck, Upper	DD-05-01	Stocked with nonreproducing fish	4A	4A	4A
Bowan	MR-12-01	Stocked with nonreproducing fish	4A	4A	4A
Coon	MM-10-01	Stocked with nonreproducing fish	4C	4C	4A
Copper[a]	MC-06-01	Stocked with nonreproducing fish	4B	4A	4A
Dagger	MR-04-01	High density reproducing fish	2B	2A	2A
Dee Dee, Upper	MR-15-01	High density reproducing fish	2B	2A	2A
Dee Dee/Tamarack, Lower	MR-15-02	Stocked with nonreproducing fish	4A	4A	4A
Despair, Lower	M-14-01	Fishless	1	1	1
Despair, Upper	M-13-01	Fishless	1	1	1
Diobsud No. 1	LS-01-01	High density reproducing fish	2A	2A	2A
Diobsud No. 2, Lower	LS-02-01	High density reproducing fish	2B	2A	2A
Diobsud No. 3, Upper	LS-03-01	Stocked with nonreproducing fish	4A	4A	4A
Doubtful	CP-01-01	High density reproducing fish	2C	2A	2A
Doug's Tarn	M-21-01	High density reproducing fish	2C	2A	2A
East, Lower	MC-14-02	Fishless	1	1	1
East, Upper	MC-14-01	Fishless	1	1	1
Firn	MP-02-01	Low density reproducing fish	3B	3A	3A
Green	M-04-01	High density reproducing fish	2B	2A	2A
Green Bench	LS-04-01	Fishless	1	1	1
Hanging	MC-08-01	High density reproducing fish	2A[b]	2A[b]	2A[b]
Hidden	SB-01-01	Low density reproducing fish	3C	3A	3A
Hidden Lake Tarn	EP-14-01	Stocked with nonreproducing fish	4A	4A	4A
Hi-Yu	M-01-01	Stocked with nonreproducing fish	4B	4A	4A
Hozomeen	HM-02-01	High density reproducing fish	2A	2A	2A
Ipsoot	LS-06-01	Low density reproducing fish	3B	3A	3A
Jeanita	DD-01-01	Low density reproducing fish	3B	3A	3A
Kettling	MR-05-01	High density reproducing fish	2A	2A	2A
Kwahnesum	MC-07-01	Stocked with nonreproducing fish	4A	4A	4A
McAlester	MR-10-01	High density reproducing fish	2B	2B	2A
Middle, Lower	MC-16-02	Fishless	1	1	1
Middle, Upper	MC-16-01	Fishless	1	1	1
Monogram	M-23-01	High density reproducing fish	2C	2A	2A
Monogram Tarn	M-23-11	Stocked with nonreproducing fish	4A	4A	4A
Nert	M-05-01	Stocked with nonreproducing fish	4A	4A	4A

TABLE 5: MANAGEMENT ACTIONS FOR EACH OF THE 91 LAKES (CONTINUED)

Lake Name	NPS Lake Code	Current Condition of Lake (as represented under alternative A)	Management Action Alternative B	Alternative C	Alternative D
Noisy Creek, Upper	LS-14-01	Fishless	1	1	1
No Name	PM-01-01	Stocked with nonreproducing fish	4C	4A	4A
Panther Potholes, Lower	RD-05-02	Stocked with nonreproducing fish	4A	4A	4A
Panther Potholes, Upper	RD-05-01	Fishless	1	1	1
Pegasus	EP-10-01	Fishless	1	1	1
Pond SE of Kettling Lakes	MR-09-01	Stocked with nonreproducing fish	4C	4C	4A
Quill, Lower	M-24-02	Stocked with nonreproducing fish	4B	4A	4A
Quill, Upper	M-24-01	Stocked with nonreproducing fish	4B	4A	4A
Rainbow	MR-14-01	High density reproducing fish	2C	2C	2A
Rainbow, Upper (North)	MR-13-01	Fishless	1	1	1
Rainbow, Upper (South)	MR-13-02	Stocked with nonreproducing fish	4A	4A	4A
Rainbow, Upper (West)	MM-11-01	Stocked with nonreproducing fish	4A	4A	4A
Redoubt	MC-11-01	Fishless	1	1	1
Reveille, Lower	MC-21-02	Fishless	1	1	1
Reveille, Upper	MC-21-01	Fishless	1	1	1
Ridley	HM-03-01	Stocked with nonreproducing fish	4C	4C	4A
Sky	EP-13-01	Fishless	1	1	1
Skymo	PM-03-01	High density reproducing fish	2C	2A	2A
Sourdough	PM-12-01	High density reproducing fish	2B	2A	2A
Sourpuss	ML-01-01	Fishless	1	1	1
Stiletto	MR-01-01	Stocked with nonreproducing fish	4B	4A	4A
Stout	EP-09-02	Low density reproducing fish	3B	3A	3A
Stout, Lower	EP-09-01	Low density reproducing fish	3B	3A	3A
Sweet Pea	ML-02-01	Stocked with nonreproducing fish	4C	4A	4A
Talus Tarn	M-06-01	Fishless	1	1	1
Tapto, Lower	MC-17-03	Fishless	1	1	1
Tapto, Middle	MC-17-02	Fishless	1	1	1
Tapto, Upper	MC-17-01	Fishless	1	1	1
Tapto, West	MC-17-04	Fishless	1	1	1
Thornton, Lower	M-20-01	Low density reproducing fish	3C	3A	3A
Thornton, Middle	M-19-01	Stocked with nonreproducing fish	4C	4A	4A
Thunder	RD-02-01	Fishless	1	1	1
Tiny	MC-15-01	Fishless	1	1	1
Torment	ML-03-01	Stocked with nonreproducing fish	4A	4A	4A
Trapper	GM-01-01	Low density reproducing fish	3B	3A	3A
Triplet, Lower	SM-02-01	High density reproducing fish	2C	2C	2A
Triplet, Upper	SM-02-02	High density reproducing fish	2A	2A	2A
Triumph	M-17-01	Stocked with nonreproducing fish	4C	4A	4A
Unnamed	FP-01-01	Fishless	1	1	1
Unnamed	MR-11-01	Stocked with nonreproducing fish	4C	4C	4A
Unnamed	MR-16-01	Low density reproducing fish	3B	3B	3A
Vulcan	ML-04-01	Fishless	1	1	1
Wilcox/Lillie, Upper	EP-06-01	High density reproducing fish	2A	2A	2A
Wilcox/Sandie, Lower	EP-05-01	High density reproducing fish	2C	2A	2A
Wild	MC-27-01	Fishless	1	1	1
Willow	HM-04-01	Stocked with nonreproducing fish	4C	4C	4A

Notes:

a. In August 2004, a large fish kill was observed in Copper Lake, possibly due to disease. Further surveys are needed to confirm that the lake is fishless.

b. Remove all reproducing fish pending agreement with British Columbia.

TABLE 6: STATUS OF FISH REPRODUCTION AND CYCLE, STOCKING DENSITY, AND SPECIES OF FISH STOCKED COMPARISON OF ALTERNATIVES A, B, AND C

This plan/EIS is based on adaptive management principles. The cycle, density, and species stocked may change in the future based on monitoring in order to better protect biological resources. The numbers represented in the table below illustrate the estimated stocking cycle, stocking density, and species of fish to be stocked in the future. Any species of fish stocked in the future would be nonreproducing. Proposed stocking density and rotation are based on current lake management. See appendix E for a complete description of the attributes of each lake.

Lake Name	NPS Lake Code	Reproducing Fish Species/Strains			Fish Species/Strains Used for Stocking			Initial Stocking Density (fry/acre)			Frequency of stocking rotation for lakes stocked under Alternatives A, B, and C (x-year cycle)
		Alternative			Alternative			Alternative			
		A	B	C	A	B	C	A	B	C	
Battalion	MLY-02-01	OM	OM	—	OM(MW)	Need data[a] OM(MW)	Need data OM(MW)	50	50	50	1
Bear	MC-12-1	OCL(TL)	—	—	—	OM(MW)	—	—	60	—	4
Berdeen	M-08-01	OCL(TL)	—	—	OM(MW)	OM(MW)	—	50	50	—	5
Berdeen, Lower	M-07-01	OCL(TL)	—	—	—	—	—	—	—	—	—
Berdeen, Upper	M-09-01	OCL(TL)	—	—	—	—	—	—	—	—	—
Blum (Largest/ Middle, No. 3)	M-11-01	OM	—	—	OM(MW)	—	—	50	60	—	4
Blum (Lower/ West, No. 4)	LS-07-01	SF	—	—	—	OM(MW)	—	—	60	—	4
Bouck, Lower	DD-04-01	OCL	—	—		OM(MW)	OM(MW)	—	60	60	4
Bouck, Upper	DD-05-01	—	—	—	OMA	—	—	60	—	—	4
Bowan	MR-12-01	—	—	—	OM(MW)	—	—	125	—	—	6
Coon	MM-10-01	—	—	—	OCL(TL)	OCL(TL)	OCL(TL)	90	90	90	5
Copper[b]	MC-06-01	—	—	—	OM(MW), OCC	Need data OM(MW)	—	65	65	—	4
Dagger	MR-04-01	OC	OC	OC	—	—	—	—	—	—	—
Dee Dee, Upper	MR-15-01	—	—	—	OM(MW)	Need data OM(MW)	Need data, OM(MW)	50	50	50	10
Dee Dee/ Tamarack, Lower	MR-15-02	—	—	—	OM(MW)	OM(MW)	OM(MW)	50	50	50	10
Diobsud No. 1	LS-01-01	OCL(TL)	—	—	—	—	—	—	—	—	—
Diobsud No. 2, Lower	LS-02-01	OCL(TL)	—	—	OM(MW)	OM(MW)	—	70	70	—	5

Table 6: Status of Fish Reproduction and Cycle, Stocking Density, and Species of Fish Stocked Comparison of Alternatives A, B, and C (continued)

Lake Name	NPS Lake Code	Reproducing Fish Species/Strains			Fish Species/Strains Used for Stocking			Initial Stocking Density (fry/acre)			Frequency of stocking rotation for lakes stocked under Alternatives A, B, and C (x-year cycle)
		Alternative			Alternative			Alternative			
		A	B	C	A	B	C	A	B	C	
Diobsud No. 3, Upper	LS-03-01	—	—	—	OM(MW)	OM(MW)	—	80	80	—	4
Doubtful	CP-01-01	OC, OM, OmxOC	—	—	—	OM(MW)	—	—	60	—	4
Doug's Tarn	M-21-01	OC	—	—	—	OM(MW)	—	—	60	—	4
Firn	MP-02-01	OCL(TL)	OCL	—	OM(MW)	Need data OM(MW)	—	50	50	—	5
Green	M-04-01	OCL(TL), OM, OCLxOM	—	—	—	Need data, OM(MW)	—	—	60	—	4
Hanging	MC-08-01	OM	—	—	—	—	—	—	60	—	4
Hidden	SB-01-01	OM(MW)	OM(MW)	—	OM(MW), OMA	OM(MW), OMA	—	20, 40	20, 40	—	4
Hidden Lake Tarn	EP-14-01	—	—	—	OM(MW)	—	—	40	—	—	6
Hi-Yu	M-01-01	—	—	—	OM(MW)	Need data OM(MW)	—	100	100	—	4
Hozomeen	HM-02-01	SF	—	—	—	—	—	—	—	—	—
Ipsoot	LS-06-01	OCB	OCB	—	—	—	—	—	—	—	—
Jeanita	DD-01-01	OMA	OMA	—	—	—	—	75	—	—	—
Kettling	MR-05-01	OC, OM, OMxOC	—	—	—	—	—	—	—	—	—
Kwahnesum	MC-07-01	—	—	—	OM (MW)	OM(MW)	—	100	100	—	5
McAlester	MR-10-01	OCL(TL)	OCL(TL)	OCL(TL)	—	—	—	—	—	—	—
Monogram	M-23-01	OCL(TL)	—	—	OM(MW)	OM(MW)	—	70	70	—	5
Monogram Tarn	M-23-11	—	—	—	OCL(TL)	—	—	No data	—	—	No Data
Nert	M-05-01	—	—	—	OM(MW)	—	—	50	—	—	4
No Name	PM-01-01	—	—	—	OM(MW)	OM(MW)	—	70	70	—	4
Panther Potholes (Lower)	RD-05-02	—	—	—	OCC	—	—	100	—	—	4

Table 6: Status of Fish Reproduction and Cycle, Stocking Density, and Species of Fish Stocked Comparison of Alternatives A, B, and C (continued)

Lake Name	NPS Lake Code	Reproducing Fish Species/Strains			Fish Species/Strains Used for Stocking			Initial Stocking Density (fry/acre)			Frequency of stocking rotation for lakes stocked under Alternatives A, B, and C (x-year cycle)
		Alternative			Alternative			Alternative			
		A	B	C	A	B	C	A	B	C	
Pond SE of Kettling Lakes	MR-09-01	—	—	—	OM(MW)	OM(MW)	OM(MW)	50	50	50	5
Quill, Lower[c]	M-24-02	OM	—	—	OM(MW)	OM(MW)	—	25	25	—	5
Quill, Upper[c]	M-24-01	OM	—	—	OM(MW)	Need data OM(MW)	—	25	25	—	5
Rainbow	MR-14-01	OM(PL)	—	—	—	OM(MW)	OM(MW)	—	60	60	4
Rainbow, Upper (South)	MR-13-02	—	—	—	OM(MW)	—	—	70	—	—	4
Rainbow, Upper (West)	MM-11-01	—	—	—	OM(MW)	—	—	50	—	—	10
Ridley	HM-03-01	—	—	—	OM(MW), OM(RL)	OM(MW), OM(RL)	OM(MW), OM(RL)	50	50	50	3
Skymo	PM-03-01	OC	—	—	OM(MW)	OM(MW)	—	50	50	—	4
Sourdough	PM-12-01	SF	—	—	OM(MW)	Need data OM(MW)	—	100	100	—	4
Stiletto	MR-01-01	—	—	—	OM(MW)	Need data OM(MW)	—	50	50	—	6
Stout	EP-09-02	OCL	OCL	—	OCC	OCC	—	100	100	—	5
Stout, Lower	EP-09-01	OCL	OCL	—	—	OM(MW)	—	—	60	—	4
Sweet Pea	ML-02-01	—	—	—	OM(MW)	OM(MW)	—	40	40	—	6
Thornton, Lower	M-20-01	OCL(TL)	OCL	—	OM(MW)	OM(MW)	—	50	50	—	6
Thornton, Middle	M-19-01	—	—	—	OMA	OMA, OM(MW)	—	50	—	—	4
Torment	ML-03-01	—	—	—	OM(MW)	—	—	40	—	—	5
Trapper	GM-01-01	OC	OC	—	—	OM(MW)	—	—	60	—	4
Triplet, Lower	SM-02-01	OCL (TL)	—	—	—	OM(MW)	OM(MW)	—	50	50	1
Triplet, Upper	SM-02-02	OCL (TL)	—	—	—	—	—	—	—	—	—
Triumph	M-17-01	—	—	—	OM(MW), OMA	OM(MW)	—	20, 70	20, 70	—	4

Table 6: Status of Fish Reproduction and Cycle, Stocking Density, and Species of Fish Stocked Comparison of Alternatives A, B, and C (continued)

Lake Name	NPS Lake Code	Reproducing Fish Species/Strains			Fish Species/Strains Used for Stocking			Initial Stocking Density (fry/acre)			Frequency of stocking rotation for lakes stocked under Alternatives A, B, and C (x-year cycle)
		Alternative			Alternative			Alternative			
		A	B	C	A	B	C	A	B	C	
Unnamed	MR-11-01	—	—	—	OM(MW)	—	—	50	—	—	5
Unnamed	MR-16-01	OC	OC	OC	—	OM(MW)	OM(MW)	—	60	60	1
Wilcox/Lillie, Upper	EP-06-01	OC, OM, OM x OC	—	—	—	—	—	—	—	—	—
Wilcox/Sandie, Lower	EP-05-01	OC	—	—	OM(MW)	OM(MW)	—	70	70	—	4
Willow	HM-04-01	—	—	—	OCC	—	—	25	—	—	1

Fish Species Legend

OC – *Oncorhynchus clarki*. This is a generic designation used for cutthroat trout where the subspecies or strain is not known. Usually these fish are Twin Lakes strain westslope cutthroat.

OCB – Yellowstone cutthroat.

OCC – *Oncorhynchus clarki clarki*. A Lake Whatcom strain of coastal cutthroat trout that originated from broodstock collected in Whatcom Lake, Washington.

OCL – *Oncorhynchus clarki lewisi.* Westslope cutthroat trout, strain unknown. A common local name for these fish is “intermontane” cutthroat trout. This subspecies of cutthroat trout is native to the east side of the Cascade Mountains; the west sides of the Rocky Mountains from the Snake River (below Shoshone Falls), north; and the east sides of the Rocky Mountains north of the Yellowstone River.

OCL(TL) – *Oncorhynchus clarki lewisi.* Cutthroat, Twin Lakes strain.

OC(TL) – *Oncorhynchus clarki*. This is a Twin Lakes strain of westslope (intermountain) cutthroat.

OM – *Oncorhynchus mykiss*. This is a genetic designation used for rainbow trout where the subspecies is not known.

OMA – *Oncorhynchus mykiss aquabonita*. This is a subspecies of rainbow trout.

OM(MW) – *Oncorhynchus mykiss*. This is a Mount Whitney strain of rainbow trout originally developed at the Mt. Whitney Hatchery, California, from several subspecies of rainbow.

OM(PL) – *Oncorhynchus mykiss*. This wild strain of rainbow from Packwood Lake in Lewis County, Washington, was the primary sources of rainbow trout broodstock in Washington from 1917 to 1934.

OM(RL) – *Oncorhynchus mykiss irideus*. Ross Lake rainbow trout native to the upper Skagit River watershed; hatched and reared at the Marblemount Hatchery.

SF – *Savelinus fontinalis.* Brook trout are a char native to eastern North America. This fish is often called “Eastern” brook trout in the west, where the name was historically used to distinguish from the rainbow trout (originally called “brook trout”).

Notes:

— means category does not apply.

a. “Need Data” indicates lakes where data would have to be obtained prior to deciding whether to stock.

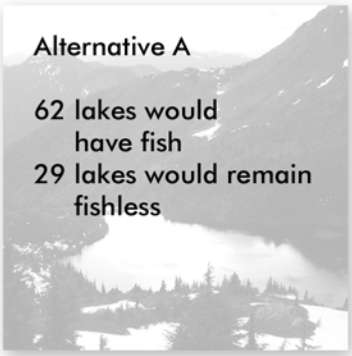
b. In August 2004, a large fish kill was observed in Copper Lake possibly due to disease. Further surveys are needed to confirm that the lake is fishless.

c. Lower Quill and Upper Quill lakes were stocked with nonreproducing fish. Limited reproduction has been observed in the past and needs to be verified.

ALTERNATIVE A

NO ACTION—EXISTING MANAGEMENT FRAMEWORK OF 91 LAKES (62 LAKES HAVE FISH)

GENERAL CONCEPT



The guiding regulations (40 CFR 1502.14) of NEPA define the no-action alternative as “no change from current management direction or level of management intensity.” Therefore, under this no-action alternative, there would be no change in the way the North Cascades Complex fishery is managed. Lakes that are currently stocked would continue to be stocked, lakes with reproducing fish would be allowed to maintain reproducing fish, and all lakes without fish would continue to be fishless. Because alternative A represents current management, it is also the baseline condition against which the action alternatives are compared.

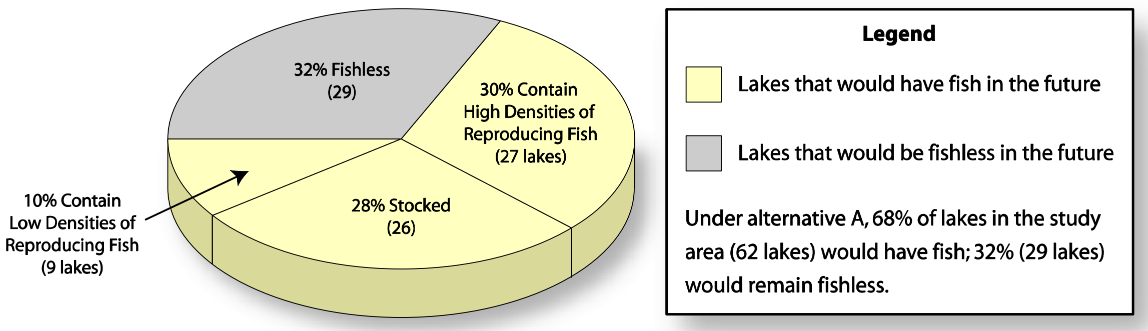
Reproducing populations of fish are able to sustain themselves over time without further stocking.

The no-action alternative would continue existing management practices in the 91 lakes slated for management consideration in the study area. Fish occur in 62 of the 91 lakes—these 62 lakes are a subset of the study area’s 91 lakes that were once naturally fishless but have a history of stocking or fish presence. The remaining 29 lakes are currently fishless and not actively managed for fish. This would continue under existing management. Of the 62 lakes, 40 are in North Cascades National Park and managed by the WDFW under the terms of the 1988 Supplemental Agreement to the 1985 Memorandum of Understanding (see appendix A). The remaining 22 of 62 lakes are in Ross Lake and Lake Chelan National Recreation Areas. The WDFW manages 19 of the 22 lakes as a recreational fishery; these 19 lakes are not part of the Supplemental Agreement, but are managed by the WDFW according to historical practices. Three of the 22 lakes are also located inside the national recreation areas but are not managed under the 1988 Supplemental Agreement nor are they actively managed by the WDFW. These 3 lakes contain fish: two with reproducing fish populations, and one with nonreproducing populations that were stocked recently enough that some fish still remain.

The continued stocking of fish in select lakes in the North Cascades Complex has occurred under both the Memorandum of Understanding and the Supplemental Agreement, in addition to a policy waiver issued in 1979 by the director of the NPS and a further policy statement issued by the NPS director in 1986 (see appendix B for the history of fishery management in the North Cascades Complex).

Under alternative A, 62 lakes in the study area would continue to have fish and 29 lakes would be left in their current fishless state, as shown in figure 4.

FIGURE 4: STATUS OF 91 LAKES UNDER ALTERNATIVE A



IMPLEMENTING THE FISHERY MANAGEMENT PLAN THROUGH CONGRESSIONAL ACTION

The enabling legislation for the North Cascades Complex does not mention fish stocking, and the legislative record regarding fish stocking in the North Cascades Complex is not clear. Therefore, the language in the enabling legislation for the portions of the North Cascades Complex in the national recreation areas does affirm that fishing is an important recreational use, but it does not mention fish stocking as being an appropriate means of fishery management. The *Washington Park Wilderness Act of 1988* (WPWA) established 93% of the North Cascades Complex as Stephen T. Mather Wilderness and directed the NPS to manage the wilderness in accordance with the *Wilderness Act of 1964*. At the time the WPWA was passed, NPS policies prohibited fish stocking in naturally fishless waters, and the WPWA did not include a provision for allowing stocking. (For more detail on legislation and history, please refer to the “History of Fish Management in North Cascades Mountain Lakes” section in the “Purpose of and Need for Action” chapter and Louter 2003).

Although the *Wilderness Act* implies that management actions that manipulate natural processes in wilderness conflict with wilderness values, stocking is not expressly prohibited in the Act. According to the definition of wilderness in the *Wilderness Act*, wilderness must retain its “primeval character and influence” so that it “appears to have been affected primarily by the forces of nature.” This language has been interpreted in the scientific literature to affirm two closely linked values that are fundamental components of wilderness character: naturalness and wildness. Naturalness has been defined as the native compositions, patterns, and processes of an area. Wildness has to do with ensuring that wilderness areas are minimally influenced by human intervention, so those who enter wilderness can experience primitive and unconfined forms of recreation. Though recreational fishing is widely regarded as an important and traditional use of wilderness, the role of stocking to create and maintain an artificial fishing opportunity in naturally fishless mountain lakes is viewed by many as an artificial manipulation of both wildness and naturalness (Landres et al. 2001). These views are supported by a wide body of scientific research into the impacts of fish stocking, including findings specific to lakes in the North Cascades Complex. However, some disagree with these views and maintain that if nonnative fish were stocked appropriately, there would be no unacceptable adverse impacts on wilderness values because biological integrity would be conserved.

Fish stocking has been allowed to continue in the North Cascades Complex under a 1986 policy waiver (see appendix A). Should a management alternative that allows for continued stocking be selected through this plan/EIS decision-making process, a new policy waiver may not be granted for several reasons. First, various national parks (Sequoia-Kings Canyon National Park, Yosemite National Park, Glacier National Park, Rocky Mountain National Park, and Yellowstone National Park) have discontinued stocking. If this plan/EIS process resulted in the selection of an alternative that allowed for continued stocking, issuance of a policy waiver to the North Cascades Complex could encourage other state fish and wildlife agencies to revisit the issue of stocking in NPS units where stocking has been discontinued. Second, policy waivers are only temporary and do not provide a permanent solution because they can be rescinded as circumstances change. The goal of this plan/EIS is to forge a lasting solution for mountain lakes fishery management in the North Cascades Complex. Finally, the minimum requirements analysis for fish stocking in the Stephen T. Mather Wilderness indicates that stocking is not necessary to meet the minimum requirements for administration of the area, and the *Wilderness Act* is unclear whether stocking is allowed in designated wilderness areas. For these three reasons, a policy waiver would not be pursued if this plan/EIS process resulted in the selection of an alternative that included continued fish stocking.

The NPS has determined that fish stocking in the Stephen T. Mather Wilderness would only be implemented if Congress granted the NPS the unambiguous legal authority to do so. Therefore, should a management alternative that allows for continued stocking be selected through this plan/EIS decision-making process, the NPS intends to ask Congress for a change to the North Cascades Complex enabling legislation to clarify how the mountain lakes should be managed. The following is an example of clarifying legislation that would allow stocking to continue in the national park:

> Notwithstanding any other provision of law, a fisheries management program that includes the stocking of fish in selected lakes within the North Cascades National Park Service Complex is authorized so long as both the National Park Service and the State of Washington agree on the lakes, species of fish, and number of fish to be stocked.

A change in the enabling legislation for the North Cascades Complex to allow for continued fish stocking would set a precedent for this NPS unit, and possibly others that have, or may have in the future, fish stocking issues. If Congress should choose to allow stocking through a change in the enabling legislation, it will have clarified that fish stocking is an appropriate activity in the North Cascades Complex. That unambiguous clarification would allow the NPS to implement any of the management alternatives that include the practice of stocking. Such an action would allow the NPS to proceed with full confidence that it is taking an action that is consistent with the way Congress intended the North Cascades Complex and the Stephen T. Mather Wilderness to be managed.

Congressional action to allow fish stocking would also honor various verbal commitments in support of stocking that proponents believe were made by federal officials prior to establishing the North Cascades Complex but never codified in law.

Congressional action to clarify enabling legislation is an intricate process that could take several years. If the NPS does not receive clarification from Congress by the time a record of decision for this plan/EIS is issued, alternative D (91 Lakes Would Be Fishless) would be implemented until clarification is received.

MINIMUM REQUIREMENTS

Although the *Wilderness Act* implies that management actions that manipulate natural processes in wilderness conflict with wilderness values, stocking is not expressly prohibited in the Act. According to section 4(c) of the *Wilderness Act*, agencies may engage in management actions that may otherwise be prohibited in wilderness provided they are necessary "to meet the minimum requirements for the administration of the area." This provision is commonly referred to as the minimum requirements (or minimum tool) provision. In accordance with NPS policy, a minimum requirements analysis must be completed before a management action can be taken in designated wilderness areas. NPS management policy 6.3.5 states that the purpose of a minimum requirements analysis is (1) to determine whether a proposed action is necessary or appropriate for administration of an area as wilderness and does not pose a significant impact to wilderness resources and character; and (2) if an action is determined to be appropriate or necessary, to determine the techniques and types of equipment needed to ensure that impacts to wilderness resources and character is minimized.

The NPS has conducted a minimum requirements analysis using a decision guide template developed by the Arthur Carhart National Wilderness Training Center (see appendix K). Congress established the Arthur Carhart National Wilderness Training Center in 1993 to "foster interagency excellence in wilderness stewardship by cultivating knowledgeable, skilled and capable wilderness managers and by improving public understanding of wilderness philosophy, values and processes." The minimum requirements decision guide template is used by each of the agencies to assist wilderness managers in making appropriate decisions for wilderness management. The minimum requirements analysis provides a method to determine the necessity of an action in wilderness areas, and how to minimize impacts, but does not bind an agency to take a particular action. Under alternative A, the NPS considers allowing stocking to continue in certain mountain lakes. The results of the minimum requirements analysis show that stocking of nonnative fish to create and enhance an artificial recreational fishery is not necessary to meet the minimum requirements for the administration of the Stephen T. Mather Wilderness (see appendix K). Continuing to stock naturally fishless lakes, as proposed under alternative A, would not leave the wilderness "ideally free from human control or manipulation." Stocking of fish would continue to manipulate the native ecology of a lake and introduce a nonnative species.

Some, including the WDFW, disagree with the conclusions reached in the minimum requirements analysis. They maintain that recreational fishing is allowed under the *Wilderness Act*, and therefore, creating and enhancing fishing opportunities are appropriate actions in wilderness areas. Those who disagree with the conclusions reached in the minimum requirements analysis also believe that if nonnative fish were stocked appropriately, there would be no unacceptable adverse impacts on wilderness values because biological integrity would be conserved. The WDFW's comments on fishery management in the Stephen T. Mather Wilderness accompany the minimum requirements analysis in appendix K.

CURRENT FISHERY MANAGEMENT PROGRAM

Current Management Framework

The management framework dictates the parameters under which the fishery management program is applied. The framework controls which lakes are stocked, stocking densities and frequencies, types of fish, methods used for stocking, and monitoring efforts. Under the current management framework for alternative A, the 62 lakes described above under "General Concept" would continue to be managed as they are today. The species currently stocked are the species historically stocked in each lake. The stocking density is guided by two factors: historical stocking densities and adaptive management to achieve maximum sustainable recreational use. Adaptive management can be used to vary the stocking density or frequency in response to reports of extra fishing pressure, low fish numbers, or condition factors. For example, if a lake has historically been stocked at a high density, it might be determined, using an adaptive management approach, that a lower density should be used with the goal of producing fish that are larger or in better condition. Lower densities also help the park meet its goal of minimizing the effect of fish on native biota. Both stocking density and frequency could be lower than planned if the fish required for stocking are not available. Appendix E shows the current status and management of the 91 lakes.

Current Stocking Program

Of the 91 lakes under consideration in this plan/EIS, 26 are currently stocked with fish. Of these 26 stocked lakes, 15 are located in the national park and managed in accordance with the 1988 Supplemental Agreement between the NPS and WDFW (see appendix A). Ten of the stocked lakes are located in the national recreation areas, and one is located in the national park but not managed as part of the 1988 Supplemental Agreement; it presently contains fish as a result of unsanctioned stocking.

A lake's physical characteristics help determine the stocking cycle and density. For instance, Ridley Lake is stocked every 3 years with 50 fish/acre (WDFW 2003). The low elevation and relatively high productivity of this lake allow the fish to grow quickly to quality fish size and sustain a more consistent fishery. Ridley also experiences more angler use and is more resistant to impacts from fish due to its lower elevation and high productivity.

Factors such as lake productivity and elevation can also alter the density of fish in a lake. Although these factors were not expressly used to estimate fish densities, other factors and available data were used to derive a relative estimate of density. Appendix H describes the methodology used to estimate current fish density where the density was not known (for both stocked and reproducing fish). Additional fish surveys are planned to determine the reproductive status and abundance of fish in these lakes (WDFW 2003).

Lakes with High Densities of Reproducing Fish

There are 27 lakes with high densities of reproducing fish, 7 are categorized as “mixed” because the reproducing (self-sustaining) populations are augmented through stocking. To diversify fish availability (thus, fishing opportunity) Berdeen, Skymo, Diobsud No. 2, Monogram, and Sourdough lakes would continue to be stocked with rainbow trout, in addition to the established reproducing (self-sustaining) populations of cutthroat trout (Berdeen, Diobsud No. 2, Monogram, and Skymo) and brook trout (Sourdough) because rainbow trout forage more effectively in the productive deep-water zones compared to cutthroat and brook trout (WDFW 2003). The stocking cycle for these lakes is 4 to 5 years, and stocking density ranges from 50 to 100 fish/acre. There are two exceptions to the 4- to 5-year stocking frequency. Battalion Lake contains reproducing populations of rainbow trout and is supplementally stocked annually with nonreproducing rainbow trout. Lower Wilcox/Sandie Lake contains reproducing cutthroat and rainbow trout and is stocked with nonreproducing rainbow trout on a 4-year cycle at 70 fish/acre.

Of the 27 lakes containing high densities of reproducing fish, 8 lakes would continue to contain high densities of reproducing cutthroat trout; 2 of the 8 lakes (Hozomeen and Lower Blum [West, No. 4]) would contain reproducing brook trout; 2 others (Rainbow and Hanging) would continue to have reproducing rainbow trout; and 4 lakes (Green, Doubtful, Kettling, and Upper Wilcox/Lillie) would contain both cutthroat and rainbow trout.

Lakes with Low Densities of Reproducing Fish

Of the 62 lakes that currently contain fish, 9 are believed to have low densities of reproducing fish; 7 of the 9 lakes are categorized as “mixed” because they contain self-sustaining populations of trout that are augmented through stocking. To diversify fishing opportunity, Middle Blum, Firn, Upper Dee Dee, Lower Thornton, and Hidden Lakes would continue to be stocked with rainbow trout, in addition to the established reproducing populations of rainbow trout (Middle Blum and Hidden) and cutthroat trout (Firn and Lower Thornton) present in these lakes. Marginal reproduction occurs in Hidden Lake, and the level is believed to be too low to sustain a population or fishery; therefore, Hidden Lake would continue to be managed as a stocked lake despite its mixed-management status (WDFW 2003). The stocking frequency for these lakes is 4 to 6 years, and stocking density ranges from 20 to 50 fish/acre. Stout Lake would continue to be stocked with coastal cutthroat trout (which are native to the watershed) in an effort to replace, over time, an existing population of westslope (intermountain)

Coastal cutthroat is a native fish found in the west-side drainages of the national park.

cutthroat. The intent is to reduce or eliminate the potential for downstream hybridization of westslope cutthroat with coastal cutthroat trout. Three of the 9 low-density lakes (Jeanita, Hidden Lake Tarn, and Lower Thornton) are on longer stocking frequencies than other stocked lakes (WDFW 2003). The longer time between stocking (6 to 7 years) helps promote optimum growth rates (resulting in larger fish) and reduces fishing pressure because fish populations are smaller near the end of stocking cycles as nonreproducing fish have been removed by fishing or natural causes.

Fishless Lakes

The remaining 29 lakes in the study area are currently fishless and would remain fishless under alternative A.

Current Stocking Practices

Stocked-only Lakes. Mountain lakes are generally stocked by the WDFW at densities of 50 to 100 fish/acre. Backpack stocking is used to minimize impacts on wilderness values and is used in almost all of the stocked lakes in the national park. Stocking frequencies (cycles) can vary from 1 to 10 years between stocking times. Most lakes in the North Cascades Complex are managed for 4- to 5-year cycles. Some lakes are on longer cycles to allow a period of several years when few or no fish are present, and other lakes are on short stocking cycles. Lakes on long cycles experience a “resting period,” which gives prey species an opportunity to reach their maximum densities. Resting periods also help reduce fishing pressure because anglers may not fish in a lake if they are unsure of fish availability and might only fish in that lake when the combination of density and fish size is appealing. Some lakes with low levels of reproducing fish are stocked to bring densities up to fishable levels or increase fish availability without exceeding densities that would impact these lakes. Lakes with high growth rate for stocked fish are often managed on short stocking cycles with a small number (less that 50 fish/acre) to produce a more consistent fishery. Lakes that experience high levels of fishing pressure (and high angling mortality of stocked fish) are also frequently managed on a short stocking cycle because fish densities drop quickly once stocked fish become large enough to interest anglers (fish generally become large enough for the sports fishery at two to three years of age).

Lakes that are Both Stocked and have Reproducing Fish. A lake may have a mixed population of fish for one of several reasons.

> *To Supplement Low Rates of Reproduction (low recruitment)* — Lakes with low levels of reproducing fish that cannot, under current fishing pressure, support densities of more than a few dozen fish per acre are often supplemented by stocking nonreproducing hatchery fish at high enough levels to maintain fishable, but relatively low (less that 100 fish/acre) densities of fish.

> *To Use Pelagic (Deep Water) Habitat and Increase Diversity of Fishing Opportunity* — Lakes with established reproducing populations of fish

(generally westslope cutthroat or brook trout), which primarily feed on macroinvertebrates found on lake bottoms in the near-shore zone, sometimes are stocked with Mt. Whitney rainbows, which feed extensively on zooplankton in the open water zone of mountain lakes. This management practice more fully utilizes the available resources of a lake for fish production and adds an additional species to the lake, diversifying the angling experience.

To Replace an Undesirable Stock (Genetic Swapping) **—** Coastal cutthroat (Lake Whatcom strain) are currently being stocked in Stout Lake, which contains a reproducing population of westslope cutthroat trout. The object of stocking coastal cutthroat is that the westslope cutthroat trout are not native to the watershed below Stout Lake, as are the coastal cutthroat. Large numbers of native coastal cutthroat are stocked with the hope they would interbreed with the nonnative westslope cutthroat trout and replace the existing population of fish with a crossbred population that either primarily represents the genotype of coastal cutthroat or is close enough to the phenotype of coastal cutthroat that they are not a threat to populations of native rainbow, coastal cutthroat, and native char in the basin below the lake.

Genotype: The genetic makeup of an organism as opposed to its physical characteristics.

Species and Strains of Fish Currently Stocked and Current Stocking Cycles and Density. Table 6 and appendix E show the species of fish currently present in North Cascades Complex lakes managed by the WDFW and the species and strains of fish used for stocking. A description of the fish used in stocking can be found under the “Aquatic Organisms” section in the “Affected Environment” chapter.

Phenotype: The visible characteristic of an organism resulting from the interaction between its genetic makeup and the environment.

Specific Times of Year When Stocking Currently Takes Place. High-elevation lakes are always stocked during the ice-free period, which varies from year to year, but is generally between mid-July to mid-September. Stocking can start as early as May in lower-elevation lakes or as late as the end of October in higher-elevation lakes that ice-out later. Stocking later than October is avoided because survival is sharply reduced if fry do not have time to acclimate to a lake and its food supply before winter (WDFW 2001). Mt. Whitney rainbow and Twin Lakes cutthroat trout are preferred for stocking mountain lakes because it is possible to rear them to an appropriate size for stocking during the summer months after ice-out. Ross Lake rainbow trout fry also reach suitable sizes for summer stocking at the appropriate time. Lake Whatcom strain cutthroat fry, however, normally are too large during the summer months for stocking by backpack or fixed-wing aircraft; therefore, hatching is delayed by chilling the water used to incubate their eggs.

Current Lake Treatments to Manage the Fishery

Under alternative A, no lakes are treated to remove fish.

Mechanical Methods

Under alternative A, no mechanical methods of fish removal are used.

Chemical Methods

Under alternative A, no lakes are chemically treated to remove fish.

Natural Methods

None of the lakes in the national park that are managed by the WDFW under the 1988 Supplemental Agreement or in the national recreation areas are allowed to become fishless by the cessation of stocking.

CURRENT MITIGATION

See appendix I for a description of current mitigation practices used to minimize potential impacts of fish stocking.

CURRENT MONITORING PROGRAM

Fishery managers currently rely on high-lake angler report cards and periodic surveys with gillnets to understand fish stock conditions. Most angler reporting originates with members of the Hi-Lakers and Trail Blazers. Anglers volunteer to collect information that yields estimates of fish abundance, growth, and species composition, as well as angler effort, success, and usage. From 1968 to 2001, 133 anglers filed 90 reports for 31 lakes in the North Cascades Complex. Because it is sporadic, this information cannot be used to confidently report whether a particular fishery is thriving or failing. However, this information, combined with data gathered by NPS staff from net sets, does provide an important source of data on the 91 lakes in the study area (WDFW 2003).

Benthic: Occurring at the bottom of a body of water.

Resource management activities in the North Cascades Complex in recent years have focused on improving the baseline knowledge of both natural and cultural resources in the park, as part of the NPS Natural Resource Challenge Initiative. The Initiative is an effort to improve management decisions by enhancing knowledge and understanding of NPS resources. In support of this effort, Congress is providing funding for inventorying, monitoring, restoration, research, and education. The aquatics program has focused on monitoring salmon in the Skagit River and its tributaries, stream resident fish populations throughout the North Cascades Complex, and on benthic (bottom dwelling) macroinvertebrate monitoring in streams and lakes throughout the North Cascades Complex. To improve knowledge of amphibian distributions, park biologists have also been systematically inventorying the distribution and abundance of amphibians in terrestrial and aquatic habitats.

The data provided by these monitoring efforts have been used in developing this plan/EIS.

COST OF IMPLEMENTATION

Not accounting for inflation, the estimated total costs for continuation of the current management program under alternative A over the next 15 years would be $270,000. For more details on cost of continuing management under alternative A, see the "Management and Operations" section in the "Environmental Consequences" chapter.

ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

MANAGING NORTH CASCADES AS A COMPLEX, AS OPPOSED TO DISCRETE UNITS

The enabling legislation for the North Cascades Complex provides separate guidance for administration of the national park and the two national recreation areas. In 1970, however, Congress declared that the NPS was to treat equally all of the areas under its charge, especially in the protection of their natural values (*General Authorities Act*, 16 USC section 1a-1). Therefore, the objectives of this plan/EIS apply equally to the recreation areas, as well as the national park.

MONITORING, DATA COLLECTION, AND FUTURE MANAGEMENT OF LAKES

Monitoring and evaluation are crucial in determining if management actions are achieving objectives. For instance, if a stocked lake begins to show unacceptable effects on native biota, that lake would be managed differently (such as reducing the density of stocked fish, changing stocking cycles, changing fish species stocked, or stopping fish stocking completely). This process of using information as it becomes available to alter management actions is called adaptive management, which is explained in the next section. This process recognizes the importance of continually learning how to manage better. Instead of adhering rigidly to a standard set of management actions, the goal is to build flexibility and adaptation into management actions. As a result of this process, the management action initially applied could be altered. These alterations may include reducing fish densities, changing stocking cycles, changing species stocked, or completely removing fish. Each action alternative in this plan/EIS employs an adaptive management element involving monitoring and evaluation. This means that, although each alternative predicts the number of lakes that would be managed by specific actions, ultimately, some of those actions may change as knowledge is gained.

The NPS would rely primarily upon soft funding (short-term sources of special funding) to implement the plan because there is no base funding available or anticipated for the foreseeable future to manage the mountain lakes fishery. Reliance on soft funding means the plan would be implemented in a piecemeal fashion as funding becomes available. The impact of this funding strategy on park operations is described in the "Operations and Management" section in the "Environmental Consequences" chapter.

ADAPTIVE MANAGEMENT

Adaptive management is based on the premise that managed ecosystems are complex and unpredictable. Adaptive management is an analytical process for adjusting management and research decisions to better achieve management objectives. This process recognizes that our knowledge about natural resource systems is uncertain; therefore, some management actions are best conducted as experiments in a continuing attempt to reduce the risk arising from that uncertainty. The goal of such experimentation is to find a way to achieve the objectives while avoiding inadvertent mistakes that could lead to unsatisfactory results (Goodman and Sojda 2004).

The NPS must use adaptive management to fully comply with Council on Environmental Quality regulations (40 CFR 1500) requiring the adoption of a monitoring and enforcement program. Adaptive management (516 Department Manual [DM] 4.16) is a system of management practices based on clearly identified outcomes; monitoring to determine if management practices are meeting outcomes; and if they are not, facilitating management changes that would best ensure that outcomes are met. The NPS must keep the public and affected regulatory and permitting agencies informed throughout the application of adaptive management. The NPS is also to provide post-activity opportunity for the public and affected agencies to review adaptive management practices (NPS 2001b, 1.1).

Implementing adaptive management is neither simple nor intuitive. It is complex because of the large number of interconnected potential scenarios, the related uncertainties, and the intricacy of necessary computations. Adaptive management is a central theme of the three action alternatives analyzed in this plan/EIS, and monitoring of the lakes is a key component of adaptive management. Adaptive management is an iterative process of applying management actions, monitoring consequences, evaluating monitoring results against objectives, adjusting management actions, and using feedback to make future management decisions. The adaptive management process for the 91 lakes in the study area would evaluate the effects of management actions (for example, allowing management of low densities of nonreproducing fish) on biological resources at an individual lake and identify whether the management action should be modified to meet the objectives for the lake. Monitoring is intended to test the success and efficacy of management actions at each lake; therefore, the proposed monitoring plan for the mountain lakes fishery (see appendix F) would provide the basis for the monitoring activities.

The specific objectives of monitoring are to

> reduce uncertainty of current conditions by gathering additional information where data are lacking.
>
> develop and refine protocols for collecting data that are cost effective, efficient, and explicitly linked to management actions.
>
> develop thresholds/criteria for data evaluation that will facilitate the adaptive management process.

perform adaptive management by evaluating the success or failure of management actions to conserve/improve biological integrity and provide quality fishing opportunities.

Under this plan/EIS, the six steps listed below would be followed when applying an adaptive management approach:

1. Existing conditions would be monitored to establish a set of baseline conditions, such as fish density, for a given lake.

2. The lake would be treated using one of the methods described in this document; for example, removing fish with antimycin or stocking the lake with low densities of nonreproducing fish.

3. The lake would be monitored for effects resulting from the management action. For example, the effects of antimycin on fish and the surrounding environment, including other organisms, would be observed and recorded. In another example, the effects of fish on the surrounding environment would be observed and recorded.

4. Based on the results of monitoring, the management action or lake treatment method would be reconsidered. A monitoring plan (see appendix F) that addresses these thresholds would be developed. If monitoring results indicated that a threshold had been exceeded, the NPS would consider applying a different type of treatment. For example, after applying a management action that allows fish in a lake, the NPS may alter the management action to reduce the density of stocked fish, change species stocked, or remove fish.

5. If the management action or lake treatment worked effectively, and no thresholds were exceeded, no change would be made to the process.

6. If results of the treatment or management action were acceptable, and no thresholds were exceeded, then the NPS would continue to apply the management action or treatment. For example, if antimycin effectively killed fish and did not harm other species or the surrounding environment, antimycin would continue to be applied in other lakes.

Adaptive management combines the advantages of scientific method with the flexibility to address the human and technical complexities inherent in managing complex environmental issues. The goal is to give policy makers a better framework for applying scientific principles to complex environmental decisions (Wall 2004). This process is illustrated in figure 5.

OUTREACH AND EDUCATION

Education and public outreach would be a large component of all action alternatives. The NPS would establish a long-term public outreach campaign to help educate and inform the public about the selected alternative. A focused

FIGURE 5: ADAPTIVE MANAGEMENT PROCESS

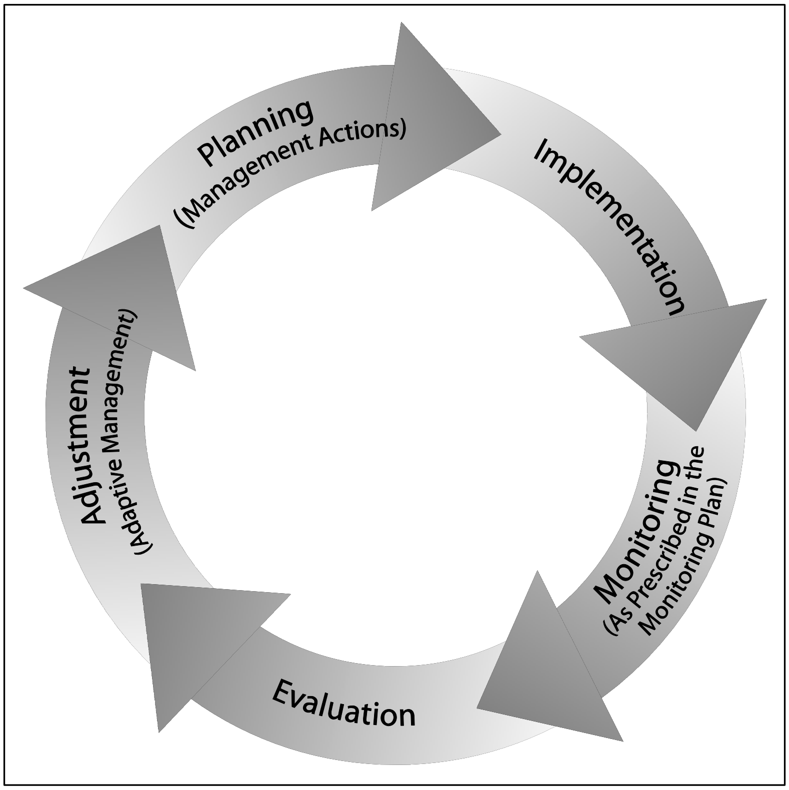


exhibit would be developed for the North Cascades Complex's two visitor centers. The NPS would also maintain a web page that presents a clear, concise, and illustrated explanation of the issue and its resolution, including multiple links from parts of the North Cascades Complex website used by backcountry travelers and mountain lake anglers. A paper version in the form of a brochure would be distributed at the visitor centers and at fairs and festivals where the North Cascades Complex is represented. The NPS would encourage media coverage of the fish removal work in the field by contacting reporters who have in the past covered science and resource management stories at the North Cascades Complex.

PARTNERSHIPS

The NPS would actively seek partnerships with the WDFW, fishing groups, and the public to implement fishery management actions. Personnel from the WDFW would also assist with fish removal. They would provide important field and logistical support and serve as an interface with various fishing groups. Local fishing groups have long been concerned about lakes with reproducing fish populations because they yield stunted fish and a poor fishing experience. These groups have expressed a strong desire to help with fishery management actions in the North Cascades Complex, and they would also be asked to assist with fish removal (NPS 2004).

Alternative D would eventually eliminate the mountain lakes fishery from the North Cascades Complex, and it may be unlikely that a partnership would be formed with WDFW or local fishing groups because they would have no incentive to participate. The NPS would still seek to form partnerships under alternative D, but with other partners, such as conservation organizations that may support the objective of complete elimination of the mountain lakes fishery.

LAKE TREATMENT METHODS

Mitigation: Activities that can prevent, reduce, or compensate for adverse environmental impacts.

Each lake has its own particular chemical and physical characteristics that dictate the best means of removing fish; therefore, methods of removing fish would differ among lakes, but the prescribed method of fish removal for a particular lake would not differ across the alternatives. There are three general methods of removing fish: mechanical, chemical, and natural. Each category includes one or more types of treatment, which are described in the following sections. Table 7 shows what lakes would be candidates for the mechanical and chemical treatment methods. In order to minimize any potential impact from lake treatment methods, mitigation measures have been identified for each type of treatment (see appendix I for a full description of current and proposed mitigation practices).

MECHANICAL METHODS

Intensive Gillnetting/ Electrofishing/Trapping

The three intensive mechanical methods of removing fish (gillnetting/ electrofishing/trapping) would not be used independently but in combination to treat appropriate lakes. A varied combination of gillneting, electrofishing, fyke nets, and traps near spawning areas would be used to catch and remove fish from lakes generally smaller than 5 acres in surface area and less than 30 feet deep. The exact choice of equipment would depend upon lake conditions. To minimize use of the piscicide, antimycin, these methods might also be tried on larger shallow lakes, provided they do not have complex substrate or other conditions that might make removal infeasible.

Fyke Net: A fish trap shaped like a bag, cylinder, or cone mounted on rings, with funnels that direct fish into successive compartments; also called a wing net.

Ecological and social concerns about using piscicides have prompted researchers to experiment with mechanical methods of removing and controlling fish. For small mountain lakes, the method that has shown the most promise is gillnetting in combination with electrofishing.

Each gillnet contains different mesh sizes in order to catch fish of different sizes. NPS personnel would place a large number of nets (from 15 to 30) in a lake like spokes of a wheel around the lake perimeter, with the smallest mesh near the shore where smaller fish tend to congregate. Larger mesh would be placed in deeper water to trap larger fish. Weighted nets would sink to the bottom and would include a floating line for retrieval. Nets and other equipment would be transported to the lakes by helicopter and placed from the shore and by a crew member using a boat or float tube (NPS, R. Zipp, pers. comm., 2003).

At Mount Rainier National Park, the NPS has successfully used gillnetting as a mechanical method for removing reproducing populations of fish in relatively small, shallow lakes (OSU, B. Hoffman, pers. comm., 2003). In the Sierra Nevada mountain range, researchers have successfully removed reproducing populations of fish using gillnets in lakes as large as 4 acres and 20 feet deep (Knapp and Matthews 1998). Based on this research, an intensive fish removal program using gillnets to remove fish from small lakes (less than 5 acres) is now underway at Sequoia Kings Canyon National Park (NPS, D. Boiano, pers. comm., 2003).

Researchers in the Canadian Rockies have also successfully removed reproducing fish using gillnets in small lakes (less than 5 acres and less than 30 feet deep) that do not have inlet or outlet streams (Parker et al. 2001). These successful case studies have prompted various estimates of gillnetting effectiveness. Lake size and depth seem to be the primary criteria that determine success or failure of gillnetting. For example, Knapp and Matthews (1998) suggest that gillnetting is a viable method for fish removal in lakes less than 7 acres and less than 33 feet. In contrast, Parker et al. (2001) suggest that gillnetting can be an effective management tool in lakes less than 25 acres and less than 33 feet deep.

There is no consensus among researchers or fishery managers as to the maximum size or depth that should be considered the “upper limit” for the usefulness of gillnets as a fish removal method. Many factors must be considered, such as lake size, depth, cost, accessibility, the presence of inlet and outlet streams, water quality, and the target fish species (Knapp and Matthews 1998; Parker et al. 2001).

The complexity of a lake’s habitat can create difficulties when removing fish with gillnets. For example, large amounts of submerged woody debris, possibly deposited in the lake from natural events (such as avalanches), could cause nets to snag and could also be used by fish for hiding, thus avoiding the nets. Shoreline complexity, such as steep slopes, rocky terrain, or dense vegetation, could also make placing nets difficult (OSU, B. Hoffman, pers. comm., 2003). Nets would be left in a lake overnight. Small crews of NPS personnel would camp near the lake for several days, checking the nets daily and removing trapped fish. Dead fish would be disposed of in the deepest parts of the lake and would sink to the bottom (fish air bladders would be punctured to ensure they do not float). Nets would periodically be moved to different locations in the lake because fish learn to avoid nets placed in one location for long periods. One crew member would remove fish from nets using a float tube, flippers and waders, or a raft, depending on conditions. Another crew member would remain on shore to record data and monitor the safety of personnel. Crews would store nets in a bear-proof box located near the lake upon leaving the site to ensure that bears would not be attracted to the smell of the nets.

Gillnetting would be costly and very time consuming and could result in injury or death to nontarget organisms such as waterfowl, mammals, and amphibians. These impacts are discussed in the “Environmental Consequences” chapter along with various mitigation measures that would be used to minimize harm to nontarget organisms.

TABLE 7: MECHANICAL AND CHEMICAL TREATMENT METHODS FOR LAKES WITH REPRODUCING NONNATIVE FISH

Lake Name	NPS Lake Code	Depth (feet)	Area (acres)	Trout/Char Species	Proposed Fish Removal Treatment Methods[a]		
					Alternative B	Alternative C	Alternative D
Battalion	MLY-02-01	16	6.3	Rainbow	Chemical[b]	Chemical	Chemical
Bear[c]	MC-12-01	152	25.7	Cutthroat	Chemical	Chemical	Chemical
Berdeen[c]	M-08-01	215	126.7	Cutthroat	Chemical	Chemical	Chemical
Berdeen, Lower	M-07-01	36	7.5	Cutthroat	Chemical	Chemical	Chemical
Berdeen, Upper	M-09-01	Unknown	9.5	Cutthroat	Chemical	Chemical	Chemical
Blum (Largest/ Middle, No. 3)[d]	M-11-01	42	12.9	Brook	Chemical	Chemical	Chemical
Blum (Lower/West, No. 4)	LS-07-01	26	6.4	Brook	Chemical	Chemical	Chemical
Bouck, Lower	DD-04-01	63	10.8	Cutthroat	Chemical	Chemical	Chemical
Dagger	MR-04-01	16	8.2	Cutthroat	Chemical	Chemical	Chemical
Dee Dee, Upper	MR-15-01	89	12.2	Rainbow	Mechanical[b]	Mechanical	Mechanical
Diobsud No. 1, separate, not connected	LS-01-01	11	1	Cutthroat	Mechanical	Mechanical	Mechanical
Diobsud No. 2, Lower	LS-02-01	17	3.1	Cutthroat	Mechanical	Mechanical	Mechanical
Doubtful	CP-01-01	68	30.2	Cutthroat, Rainbow	Chemical	Chemical	Chemical
Doug's Tarn	M-21-01	10	5.0	Cutthroat	Mechanical	Mechanical	Mechanical
Firn	MP-02-01	38	5.7	Cutthroat	Data Needed[e]	Chemical	Chemical
Green[c]	M-04-01	153	80.0	Cutthroat, Rainbow	Chemical	Chemical	Chemical
Hanging[c,f]	MC-08-01	Unknown	88.8	Rainbow	Chemical	Chemical	Chemical
Hidden[c]	SB-01-01	258	61.7	Rainbow	NA[g]	Chemical	Chemical
Hozomeen[c]	HM-02-01	67	97.4	Brook	Chemical	Chemical	Chemical
Ipsoot	LS-06-01	51	8.9	Cutthroat	Data needed	Chemical	Chemical
Jeanita	DD-01-01	8	1.4	Rainbow	Data needed	Mechanical	Mechanical
Kettling	MR-05-01	23	9.9	Cutthroat, Rainbow	Chemical	Chemical	Chemical
McAlester	MR-10-01	23	13.2	Cutthroat	Chemical	Chemical	Chemical
Monogram[c]	M-23-01	122	29.1	Cutthroat	Chemical	Chemical	Chemical
Rainbow	MR-14-01	108	15.5	Rainbow	Chemical	Chemical	Chemical
Skymo	PM-03-01	20	10.8	Cutthroat	Chemical	Chemical	Chemical
Sourdough	PM-12-01	107	27.6	Brook	Chemical	Chemical	Chemical
Stout[c]	EP-09-02	176	25.2	Cutthroat	Data needed	Chemical	Chemical
Stout, Lower	EP-09-01	8	1.0	Cutthroat	Data needed	Mechanical	Mechanical
Thornton, Lower	M-20-01	108	55.1	Cutthroat	NA	Chemical	Chemical
Trapper[c]	GM-01-01	161	147.2	Cutthroat	Data needed	Chemical	Chemical

TABLE 7: MECHANICAL AND CHEMICAL TREATMENT METHODS FOR LAKES WITH REPRODUCING FISH (CONTINUED)

					Proposed Fish Removal Treatment Methods[a]		
Lake Name	**NPS Lake Code**	**Depth (feet)**	**Area (acres)**	**Trout/Char Species**	**Alternative B**	**Alternative C**	**Alternative D**
Triplet, Lower	SM-02-01	7	2.2	Cutthroat	Mechanical	Mechanical	Mechanical
Triplet, Upper	SM-02-02	13	2.3	Cutthroat	Mechanical	Mechanical	Mechanical
Unnamed	MR-16-01	7	1.9	Cutthroat	Data needed	Data needed	Mechanical
Wilcox/Lillie, Upper	EP-06-01	65	10.5	Cutthroat, Rainbow	Mechanical	Mechanical	Mechanical
Wilcox/Sandie, Lower	EP-05-01	20	5.4	Cutthroat, Rainbow	Mechanical	Mechanical	Mechanical

Notes:

a. Experience and knowledge gained in removing fish from these lakes would be used in an adaptive management fashion to refine treatment methods for removing fish in the remaining lakes; therefore, proposed treatment methods could change as new information emerges. For this plan/EIS, however, the impact analysis of fish removal (see the "Environmental Consequences" chapter) assumed that treatment methods would be performed as indicated in this table. Complete removal of fish may not be feasible for these lakes.

b. "Chemical" means that chemical methods would be limited to application of antimycin (trade name Fintrol®), a potent, yet short-lived, piscicide (fish toxicant).

"Mechanical" means that mechanical treatment methods would include gillnetting in combination with electrofishing, hook and line, fyke nets, and cobbling over of spawning habitat. Fish removal using either mechanical or chemical methods may not be feasible for some lakes; a feasibility analysis is provided later in this chapter.

c. Lakes where complete removal of fish may not be feasible. See further discussion and explanation of assumptions in this section and in table 8.

d. Lakes highlighted in gray would be among the first lakes to undergo fish removal.

e. "Data needed" means that additional data are needed to determine whether fish should be removed under alternative B.

f. Remove all reproducing fish pending agreement with British Columbia.

g. "NA" means that fish removal is not part of the overall management action for the respective alternative.

Netting would likely occur over a 2- or 3-year period and would be repeated until the amount of fish caught decreased to zero. When fish were no longer caught, the nets would be placed a few more times to reaffirm that all fish had been removed.

Nets would be placed during the ice-free seasons (summer and fall), and the duration would depend upon lake location. Lakes at lower elevations thaw in April and May, and lakes at higher elevations thaw in July and August (some lakes are ice-free for only one or two months out of a year) (Liss et al. 1995).

Monitoring protocols would be used to document the recovery of native biota in the lakes, with an emphasis on measuring the abundance and diversity of various indicator taxa (amphibians, large crustacean zooplankton, and macroinvertebrates) known to be sensitive to fish predation.

Electrofishing would be used in conjunction with gillnets to catch and remove fish from habitable inlet or outlet streams. With this method, fish would be electrically stunned by crews using either a gasoline- or battery-powered backpack-mounted generator. Due to minimum tool concerns in wilderness, preference would be given to solar-rechargeable batteries rather than gas generators. Fish caught in the electrical current created by this method would be stunned or killed by an electrical field. Dead fish would be netted, and shocked fish would be killed by NPS crews. As described earlier, the fish would then be disposed of in the deepest part of the lake to sink to the bottom (NPS, R. Zipp, pers. comm., 2003).

Electrofishing is not effective in lakes with low ionic (containing matter in the form of charged atoms or groups of atoms) content, such as those in the study area, because the current does not carry very far through the water. However, because the electrical current travels only short distances, it is effective for removing fish in small, shallow inlet and outlet streams and in areas that are hard to access with nets (NPS 2004). Candidates for the electrofishing method are inlet and outlet streams of lakes that are gillnetted.

Traps (entrapment gear) would be used in conjunction with gillnets to catch and remove fish near inlet or outlet streams. Fyke nets would be set in lakes near the mouths of tributaries and lake outlets where trout congregate to feed or spawn. One or more wings of netting attached to the fyke net mouths would be set perpendicular to the movement of the fish to guide them into the enclosure or “pot” of the net, where they would be collected daily. Fyke nets use a finer mesh than gillnets and are more efficient in capturing juvenile trout. Small traps, such as minnow traps, could be used effectively to remove juvenile trout from lakes and shallow inlet/outlet streams. Fish removed from traps would be killed by NPS crews and, as described earlier, placed in the deepest part of the lake to sink to the bottom.

Spawning Habitat Exclusion

Most fish species spawn in the gravelly, highly oxygenated areas of moving water found in outlet and inlet streams. Certain large lakes in the North Cascades Complex, such as Upper Wilcox/Lillie Lake, appear to have limited spawning habitat in their inlet and outlet streams. Fishery management experts have suggested that a simple and effective method for reducing or eliminating fish reproduction (and eventually eliminating fish or reducing fish densities), would involve blocking access to spawning grounds by “cobbling over” gravel beds (WDFW 2001). This approach has been successfully used on an experimental basis in the Sierra Nevada mountain range (NPS, D. Boiano, pers. comm., 2003; NPS 2004; NPS, R. Zipp, pers. comm., 2003).

Without spawning habitat, fish would not successfully reproduce, thereby breaking the reproductive cycle. Some species (such as brook trout) can spawn along the shoreline or where upwellings of ground water occur (Behnke 2002), so lakes would have to be carefully selected for this type of fish removal (NPS, R. Zipp, pers. comm., 2003).

In lakes with limited spawning habitat, such as Wilcox/Lillie, Upper, NPS crews and volunteers could hand-carry small rocks from adjacent areas (such as talus slopes) and place them over spawning gravels. Field surveys indicate that spawning habitat at Wilcox/Lillie, Upper is limited to a 30-foot section of the inlet streambed. A large supply of cobble is readily available from an adjacent talus slope, so crews would transport small rocks a short distance to block access to spawning gravels in the inlet or outlet stream. Although labor intensive, this approach could provide a useful, minimally invasive tool for removing fish from other large lakes with limited spawning habitat (NPS 2004).

Lakes that would be candidates for this method are those that contain very limited spawning habitat and do not contain brook trout.

CHEMICAL METHODS

The following provides an overview of the use of antimycin and its effects. For more information, see the “Environmental Consequences” chapter.

Antimycin

Piscicides, including rotenone and antimycin, have been used to remove fish from mountain lakes. Rotenone has traditionally been used to remove fish from lakes and streams; however, rotenone is toxic to a variety of aquatic organisms and can be harmful to people who apply it, so special handling is required. Rotenone often eliminates crustacean zooplankton immediately, and amphibian larvae and metamorphosing amphibians are vulnerable to normal treatment concentrations of rotenone (Bettoli and Maceina 1996). Rotenone is also less effective on fish in the cooler water temperatures found in mountain lakes. For these reasons, the park would not select rotenone as its first choice for a chemical treatment, but if antimycin (the first choice for chemical treatment) proved ineffective, rotenone could be considered for use. Use of rotenone would require additional analysis of environmental impacts in compliance with NEPA. This analysis would include public comment and input.

Piscicides: Chemicals such as rotenone and antimycin that are used to remove fish from lakes.

The discovery of the piscicidal (fish killing) properties of the antibiotic antimycin in the early 1960s provided biologists with another chemical that can be used for fish removal (Derse and Strong 1963; Bettoli and Maceina 1996). Antimycin has shown several advantages over rotenone: it is more effective in killing fish (Bettoli and Maceina 1996; Berger et al. 1969; Rosenlund and Stevens 2002); is more effective in colder water; works well in water up to a pH of about 8; and, most importantly, has relatively small and short-term effects on other aquatic life when applied at piscicidal concentrations. Small amounts of the chemical are required to kill fish because antimycin is toxic to fish in extremely low concentrations. Antimycin has other advantages over rotenone; for example, trout do not avoid waters treated by antimycin. Also, when the elevation of a lake outlet stream drops 260 to 500 feet, it appears that antimycin naturally degrades. This apparent degradation has been attributed to rapid oxidation in turbulent waters (Rosenlund and Stevens 2002). In aquatic environments, antimycin enters the fish gills and irreversibly blocks cellular respiration (Rosenlund and Stevens 2002). The concentration of antimycin necessary to remove fish has a fairly wide range of impacts on aquatic organisms, depending upon taxonomic groups. For example, the toxicity of antimycin to aquatic invertebrates is similar to that of fish (Finlayson et al. 2002). Antimycin is considered to be harmless to waterfowl, mammals, and humans at the relatively minute (4–8 parts per billion) concentrations needed to control trout (Rosenlund and Stevens 2002; Schnick 1974).

Taxon or taxa (pl.): Category of organisms. Any of the groups to which organisms are assigned according to the principles of taxonomy, including species, genus, family, order, class, and phylum.

Antimycin has been used to remove nonnative trout from many lakes, reservoirs, and streams in the western United States. The NPS and U.S. Fish and Wildlife Service, for example, have successfully used antimycin since 1973 to remove nonnative trout and restore native greenback cutthroat trout in Rocky Mountain National Park and the headwaters of the Leadville National Fish Hatchery. In addition, antimycin has been used in a lake in Great Basin National Park and a stream at Crater Lake National Park. Use of antimycin at Rocky Mountain National Park has demonstrated that dose concentrations as low as 2 parts per billion can be very effective in removing trout from cold, neutral pH lakes. Given the successful use of antimycin in Rocky Mountain National Park, its limited toxicity to nontarget species, and its rapid degradation, antimycin would be the preferred piscicide for fish removal under the alternatives in this plan/EIS.

The only commercially available form of antimycin is Fintrol®, a restricted-use pesticide with U.S. Environmental Protection Agency registration number 39096-2. Fintrol® is sold in 20% liquid concentrate form as a fish toxicant kit that includes 240 cubic centimeters (cc) of Fintrol® concentrate and 240 cc of a diluting agent (that is, a substance that allows antimycin to mix with water). The diluting agent and concentrate are mixed together to form one unit of antimycin that is designed to treat still and running waters. One unit of antimycin (480 cc) can treat 38 acre-feet of water at a concentration of 1 part per billion. For more information, a copy of the Fintrol® label and published application instructions are provided in appendix L. (Note: 1 cc equals about .034 ounce.)

Prior to the application of antimycin, biologists would obtain lake information such as volume, water flow from any inlet or outlet streams, fish species present, water temperature, and pH.

The amount of antimycin required to kill fish would be determined by gathering the following information: an accurate estimate of lake volume and water flow into and out of the lake, the species of fish present, water temperature, and pH (Rosenlund and Stevens 2002). Antimycin requires a certain amount of contact time with fish in order to be effective, and the amount of time varies; for example, lakes with shorter residence times (time required for water to flow through the lake) would require a higher concentration (Rosenlund and Stevens 2002). Crustacean zooplankton exposed to temporarily higher concentrations near inlet streams may be affected, and some mortalities could occur even at normal treatment concentrations. No mortalities are known to occur in vertebrates through direct or indirect contact or consumption of antimycin-killed fish (Gilderhus 1969). Mammals can be sensitive to antimycin, although not at concentration levels proposed for treatment. Furthermore, the degradation products of antimycin are not believed to be toxic (Bettoli and Maceina 1996).

Due to the weight and volume of the chemical and the equipment needed for application, a helicopter would deliver the chemicals, application equipment, and a lightweight portable boat with an outboard motor to all lakes requiring chemical treatment (NPS, R. Zipp, pers. comm., 2003). A grid pattern across the lake would be used for applying the treatment by boat, and application rates would be based on calculations of lake volume and residence time. Antimycin would be diluted with lake water and then injected into the prop wash of a small motor. Bilge pumps would also be used to help mix the chemical in deeper water (Rosenlund and Stevens 2002). A bucket containing dilute antimycin would drip the piscicide into streams flowing into the lake to carry a plume of piscicide into deeper lake water. Because water entering the lake from streams is usually colder than lake water, the drip station set at these locations would help mix the chemical with this colder water that would sink to the lake's bottom (NPS, R. Zipp, pers. comm., 2003). Crews on the shoreline would use a diluted mixture of antimycin to hand-treat areas that could not be reached by boat.

Treatment with antimycin would occur during late summer and fall because water flows are lowest in the fall, meaning less water is moving into and out of the lake. Because antimycin is not effective on salmonid eggs in stream habitats, it would also be beneficial to treat the lake before fish spawn, which occurs at different times of the year depending on the species. Hatchery fish usually spawn in the fall; some other fish spawn earlier (NPS, R. Zipp, pers. comm., 2003).

Trout exposed to lethal concentrations of antimycin gradually lose their fright response and dark coloration. Small trout (less than 12 inches in length) exposed to concentrations between 2 to 8 micrograms per liter (µg/L) for eight hours typically die within 24 hours. Larger trout can live longer but are usually approaching death within 48 hours. Larger fish with antimycin markings (that is, loss of dark coloration) often feed on smaller fish that have succumbed earlier in the treatment process (Rosenlund and Stevens 2002). Dead fish float either to the lake's surface or sink to the bottom. Crews would net the floating dead fish, puncture the fishes' air bladders, and sink the carcasses in deep areas of the lake (NPS, R. Zipp, pers. comm., 2003).

Bioassay:

A technique for determining the concentration or potency of a substance, such as a drug, by measuring its effect on a living organism.

Careful monitoring using bioassay techniques would be used to ensure appropriate concentrations were being applied. Livecars (permeable cages) of fingerling rainbow trout would be placed in the lake and the outlet stream. The livecars in the lake would be monitored for fish mortality. The livecars in the outlet stream would be monitored to determine if detoxification of the outlet stream were needed. If mortality were documented, a 1 part per million concentration of potassium permanganate (an oxidizing agent that breaks down antimycin) would be dripped into the outlet stream. Livecars would be placed downstream of the potassium permanganate drip stations and monitored for at least 48 hours after treatment. The outlet stream would be considered detoxified if the fingerlings survived for more than 48 hours.

The preferred method of detoxification would be to allow natural oxidation as elevation drops in the outlet stream. For lakes where passive detoxification would not be possible due to low-gradient outlet streams or other factors (for example, rare or sensitive taxa in the outlet stream), one of two active methods would be used to detoxify antimycin. The preferred method would be to temporarily dam the lake's outlet stream with plastic sheeting. This mitigation measure would temporarily prevent antimycin-tainted water from leaving the lake and allow detoxification in the lake. For lakes with outlet streams that could not be temporarily dammed, potassium permanganate drip stations would be placed in the outlet stream. However, natural oxidation of antimycin in the outlet stream would be preferred because potassium permanganate would cause long-term staining of the outlet stream (WDFW, B. Pfeifer, pers. comm., 2004). According to Morrison (1987), potassium permanganate has no adverse impacts on water quality or nontarget organisms. Lakes that would be candidates for fish removal with antimycin would be larger than 5 acres in surface area and greater than 30 feet deep or would have an inlet or outlet stream that is habitable by fish.

Ideally, only one application of antimycin would be needed; however, repeat treatments could be required under certain unpredictable circumstances, such as incomplete mixing, water quality factors that reduce antimycin toxicity, short contact times due to high flows, or errors in calculating the volume of lake water due to an incomplete understanding of the actual depth of a lake (B. Rosenlund, pers. comm., 2003).

As an example of the treatment process, the steps for treating Lower Blum (West, No. 4) Lake are discussed. At 6.4 acres and 26 feet deep, the lake contains approximately 55 acre-feet of water. To achieve an effective dose concentration of at least 4 parts per billion, a minimum of 5.5 units of antimycin (2,640 cc or 88 oz.) would be required. The piscicide would be applied with a motorized lightweight boat that would be transported to the site via helicopter. The chemical would be dripped into the prop wash of the outboard motor to maximize mixing. Crews would also work along the lakeshore, treating shallow areas not effectively reached by boat. The outlet stream would be treated with a potassium permanganate solution to neutralize the antimycin and prevent impacts on nontarget species downstream. The application would take place in early August during low flows.

Brook trout would be removed from Lower Blum and Middle Blum lakes using a three-phased approach, including assessment (year 1), treatment (year 2), and follow-up (year 3). During the assessment phase, detailed physical, chemical, and biological data would be collected to improve the understanding of the abundance, diversity, and potential sensitivity of native aquatic species in the lake. Additional data about lake size and depth would be gathered to ensure antimycin calculations were correct. Data would also be gathered on the abundance and diversity of native aquatic species, and the data would then be used to evaluate the impacts of antimycin on those species. The lakes would be treated during the second year, with a possible follow-up treatment should the first treatment fail. Bioassays would monitor the progress and effectiveness of the treatment. The assays would involve placing cages of live fish (livecars) into the lake prior to the start of treatment, then monitoring mortality. Sampling with gillnets would also be used to determine the efficiency of the application.

During the third year, recovery of native organisms would be monitored. Longer-term monitoring would be incorporated into the North Cascades Complex's day-to-day resource management activities (NPS 2004). Refer to the "Management and Operations" section in the "Environmental Consequences" chapter.

FEASIBILITY OF FISH REMOVAL

The use of antimycin to remove reproducing fish populations is proposed as a management action common to the three action alternatives. The impact analysis for fish removal actions assumes that removal is possible and would be performed according to provisions of each management alternative (the impact analysis is provided in the "Environmental Consequences" chapter). Complete removal, however, may not be feasible for some lakes (refer to table 7). If it is determined that complete fish removal using antimycin is not possible, other methods of removal may need to be considered. A lake-specific NEPA analysis would be completed in the future if implementation of alternative fish removal methods were required.

Many factors govern the feasibility of successfully removing reproducing populations of fish. Table 8 provides some of the most important factors that must be considered before treating a lake with the piscicide antimycin (trade name Fintrol®) (Rosenlund and Stevens 2002). Lake-specific data are lacking for many of the factors presented in table 8, and since complete data are not available, lake size (surface area in acres) and an estimate of lake volume were used for a preliminary assessment of the feasibility of fish removal. Feasibility of fish removal was assumed to be low if lake surface area exceeds 50 acres or lake volume exceeds 1,000 acre-feet. Table 7 (presented earlier) identifies the nine lakes having characteristics that could make complete fish removal infeasible.

NATURAL TREATMENT METHODS

Lakes that would be candidates for the natural treatment method are those that contain only nonreproducing stocked fish. For lakes that contain only stocked fish that do not reproduce, the method of treatment may be as simple as ceasing stocking. The natural die-off of all remaining fish could take 7 to 10 years, or in exceptional cases, as long as 15 years (Nelson 1987). Water temperature is the biggest factor in determining the life span of a trout or char (Behnke 2002). Fish in lakes at higher elevations with shorter ice-free periods live longer; conversely, fish in lakes at lower elevations with longer ice-free periods do not live as long. Angling and predation also affect fish longevity, as does fish density, but to a lesser degree. Greater numbers of fish result in fewer food sources and a reduced life span (NPS, R. Zipp, pers. comm., 2003).

The initial decline in fish densities could be accelerated by providing incentives for anglers to catch and remove the fish, such as increased bag limits. For lakes where the rate of reproduction is very low and likely not to occur at all in some years, it may also be possible to use natural attrition to remove the fish over a period of years, especially if natural reproduction has been supplemented by stocking of nonreproducing fish. Table 9 identifies the lakes that are candidates for the natural treatment method under each action alternative. It is important to note that for this plan/EIS, the impact analysis of fish removal in the "Environmental Consequences" chapter assumes that natural treatment methods would be performed as indicated in this table.

TABLE 8: FACTORS THAT MAY AFFECT THE FEASIBILITY OF SUCCESSFULLY REMOVING REPRODUCING POPULATIONS OF FISH FROM LAKES

Factor	Description
Lake surface area	It takes more time to apply piscicide to larger lakes than smaller lakes. Rosenlund and Stevens (2002) recommend treatment rates not to exceed 2 hectares per hour (or 4.94 acres per hour). Large lakes might require multiple sets of treatment equipment and several crews to hasten application rates and maximize fish exposure to toxic concentrations of antimycin prior to its degradation. As lake size increases, it might be more difficult to thoroughly treat the lake surface, and this could result in uneven treatment and fish survival (treatment failure).
Lake volume	Accurate measurements of lake volume are needed in order to calculate quantities of antimycin required for treatment. Estimates of lake volumes are made using maximum depth and surface area data, and the assumption of a simple conical shape to the lake basin. As lake volume increases, the ability to evenly distribute antimycin in the water column decreases, especially in deeper areas. Incomplete mixing could prevent a complete fish kill and lead to treatment failure.
Residence time	Residence time is needed in order to estimate the contact time and dose concentration of antimycin required for effective treatment. It would be more feasible to treat lakes with long residence times because fish would have greater exposure to toxic concentrations of antimycin (that is, longer contact time).
Shoreline complexity	Lakes with highly irregular shorelines have a greater littoral zone (shoreline) surface area; therefore, more time is required to apply piscicide to shallow areas where fish can potentially escape lethal doses.
Bathymetric complexity	In lakes with irregularly shaped basin forms, it might be more difficult to apply piscicide thoroughly and evenly throughout the water column. Calculations assuming a simple conical shape would be less accurate, increasing the potential for incomplete treatment. All lakes greater than 5 acres in size should be surveyed and mapped for volume and bathymetry (the measurement of water depth at various places in a water body). Until these surveys are performed, a conical shape is assumed.
Woody/rocky debris	Large amounts of debris can create hiding areas for fish and can also increase application difficulties by hampering boat access.
Downstream/ upstream dispersal	Lakes connected by streams passable to fish should be treated concurrently, or not at all, if there is a potential for fish to recolonize the lakes.
Habitable inlet/outlet streams	Habitable inlet/outlet streams should be treated concurrently with the lake to prevent recolonization. Extensive inlet/outlet streams with no fish barriers would greatly limit feasibility of fish removal if these systems could not be treated adequately.
pH	Alkaline waters (pH exceeding 8.5) rapidly degrade antimycin and greatly limit toxicity by reducing lethal concentration contact time. Most lakes in the North Cascades Complex have a pH that is near the neutral level of 7.0.
Water temperature	Low temperatures reduce the toxicity of antimycin. Colder waters (less than 60°F) require longer treatment times or greater treatment concentrations.

TABLE 9: NATURAL TREATMENT METHODS FOR LAKES WITH NONREPRODUCING FISH

Lake Name	NPS Lake Code	Nonnative Trout Species	Proposed Fish Removal Methods		
			Alternative B	Alternative C	Alternative D
Bouck, Upper	DD-05-01	Rainbow	Natural	Natural	Natural
Bowan	MR-12-01	Rainbow	Natural	Natural	Natural
Coon	MM-10-01	Cutthroat	NA[a]	NA	Natural
Copper[b]	MC-06091	Rainbow, Cutthroat	Data needed[c]	Natural	Natural
Dee Dee/Tamarack, Lower	MR-15-02	Rainbow	Natural	Natural	Natural
Diobsud No. 3, Upper	LS-03-01	Rainbow	Natural	Natural	Natural
Hidden Lake Tarn	EP-14-01	Rainbow	Natural	Natural	Natural
Hi-Yu	M-0-01	Rainbow	Data needed	Natural	Natural
Kwahnesum	MC-07-01	Rainbow	Natural	Natural	Natural
Monogram Tarn	M-23-11	Cutthroat	Natural	Natural	Natural
Nert	M-05-01	Rainbow	Natural	Natural	Natural
No Name	PM-01-01	Rainbow	NA	Natural	Natural
Panther Potholes, Lower	RD-05-01	Cutthroat	Natural	Natural	Natural
Pond SE of Kettling Lakes	MR-09-01	Rainbow	NA	NA	Natural
Quill, Lower	M-24-02	Rainbow	Data needed	Natural	Natural
Quill, Upper	M-24-01	Rainbow	Data needed	Natural	Natural
Rainbow, Upper (South)	MR-13-02	Rainbow	Natural	Natural	Natural
Rainbow, Upper (West)	MM-11-01	Rainbow	Natural	Natural	Natural
Ridley	HM-03-01	Rainbow	NA	NA	Natural
Stiletto	MR-01-01	Rainbow	Data needed	Natural	Natural
Sweet Pea	ML-02-01	Rainbow	NA	Natural	Natural
Thornton, Middle	M-19-01	Rainbow	NA	Natural	Natural
Torment	ML-03-01	Rainbow	Natural	Natural	Natural
Triumph	M-17-01	Rainbow	NA	Natural	Natural
Unnamed	MR-11-01	Rainbow	NA	NA	Natural
Willow	HM-04-01	Cutthroat	NA	NA	Natural

Notes:

a. “NA” means that fish removal is not part of the overall management action for the respective alternative.

b. In August 2004, a large fish kill was observed in Copper Lake, possibly due to disease. Further surveys are needed to confirm that the lake is fishless.

c. “Data needed” means that the densities of reproducing fish are currently unknown, and more data are needed to determine whether fish densities are high enough to justify removal. If fish removal were deemed necessary where data are missing, treatment methods identified for the action alternatives would be implemented. At this time, it is envisioned that natural fish removal would be implemented.

ALTERNATIVE B

PROPOSED ADAPTIVE MANAGEMENT OF 91 LAKES UNDER A NEW FRAMEWORK (42 LAKES MAY HAVE FISH) (PREFERRED ALTERNATIVE)

GENERAL CONCEPT

Alternative B

29 lakes would have fish
49 lakes would be fishless
13 lakes would be evaluated for restocking

This alternative would conserve biological integrity in lakes by eliminating or reducing (if elimination proved infeasible) reproducing fish populations. Sport fishing would continue to be managed in lakes where the risks to biological integrity could be minimized through application of management principles described earlier in the section titled “Development of Management Actions for Alternatives B and C.” A number of mountain lakes in the North Cascades Complex would be returned to their naturally fishless conditions using mechanical, chemical, and natural treatment methods of fish removal. It may not be feasible to remove reproducing populations of fish in the nine larger, deeper lakes identified in table 7, so these lakes would continue to provide residual sport-fishing opportunities for the foreseeable future, and the goal of complete removal might never be achieved.

Select lakes would be stocked with low densities of fish incapable of reproduction in order to prevent reestablishment of self-sustaining populations. Stocked fish would be native to the basin or sterile to minimize the potential impacts of downstream dispersal (table 18 in the “Affected Environment” chapter provides more information on the fish that are considered native to the basin). The management actions described in table 4 would be applied to the 91 lakes as shown in table 5. For the current status and condition of the 91 lakes, refer to table 5 and appendix E.

As noted in the description of alternative A (existing management), 62 of the 91 lakes in the study area have fish, and the remaining 29 lakes are fishless. Under alternative B, 10 management actions would be available for a given lake depending on its current status and characteristics. These adaptive management actions, discussed earlier under “Adaptive Management” in the “Elements Common to All Action Alternatives” section, have been summarized into the management actions for alternative B as shown in table 10 and figure 6. For some lakes, monitoring may indicate the need for a change in management action. Ultimately, any lake that would contain fish from the initial implementation of this alternative could be considered for complete fish removal in the future based on the results of monitoring (see appendix F for details regarding monitoring).

TABLE 10: PROPOSED MANAGEMENT ACTIONS FOR ALTERNATIVE B

Management Action (number)[a]	Number of Lakes	
Lakes that would continue to have fish under alternative B[b,c]		
	Inside a national recreation area	Inside the national park
Continue to stock with nonreproducing fish (4C)	5	4
Remove reproducing fish, allow lake to rest, and restock with nonreproducing fish (2C)	3	8
Evaluate reproductive status of fish, allow low densities of fish (reproducing or nonreproducing) (3B)	1	6
Supplement the low densities of reproducing fish presently in the lake with stocked nonreproducing fish (3C)	0	2
Subtotal	**9**	**20**
Lakes that would become or be maintained fishless under alternative B		
	Inside a national recreation area	Inside the national park
Discontinue stocking of lake (nonreproducing) (4A)	5	7
Treat lakes to remove low-density reproducing fish (3A)	0	0
Treat lakes to remove high-density reproducing fish (2A)	2	6
Maintain as fishless (1)	3	26
Subtotal	**10**	**39**
Lakes to be evaluated prior to determining management action under alternative B		
	Inside a national recreation area	Inside the national park
Discontinue stocking lake, gather information, determine if lake should be restocked (4B)	0	5
Remove reproducing fish, gather information, determine if lake should be restocked (2B)	3	5
Subtotal	**3**	**10**
	Inside a national recreation area	Inside the national park
Grand Total	**22**	**69**

Notes:

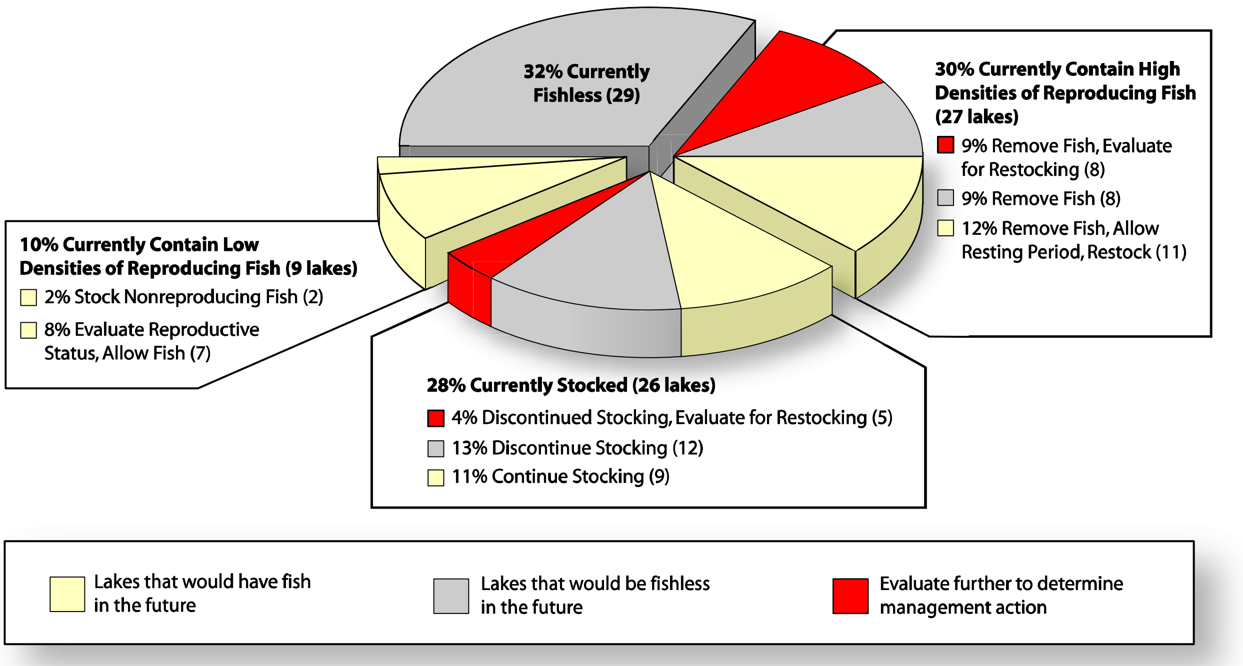
a. For a full description, see the “Management Actions” section and tables 4 and 5 in this chapter.

b. These lakes would continue to have fish based on the management action as first applied. For some, if monitoring indicates a problem, the availability may be reduced in the future.

c. The possible future outcome of alternative B would be that 42 lakes may have fish, which is the total of 29 lakes that would continue to have fish, combined with the 13 lakes that would be evaluated to determine if they should be restocked.

FIGURE 6: STATUS OF 91 LAKES UNDER ALTERNATIVE B

Under Alternative B, 32% of lakes in the study area (29 lakes) would have fish; 54% (49 lakes) would become fishless; 14% (13 lakes) would be evaluated for restocking. This means that a maximum of 42 lakes may have fish.



IMPLEMENTING THE FISHERY MANAGEMENT PLAN THROUGH CONGRESSIONAL ACTION

Under alternative B (as in alternative A), in order to continue stocking lakes in the North Cascades Complex, the NPS would seek congressional action to provide clarification of the enabling legislation for the North Cascades Complex. Refer to “Implementing the Fishery Management Plan through Congressional Action” in the description of alternative A that was presented earlier in this chapter. Congressional action to clarify its intent in the enabling legislation for the North Cascades Complex to allow for continued fish stocking would set a precedent for this NPS unit, and possibly others that have, or may have in the future, fish stocking issues.

MINIMUM REQUIREMENTS

Under alternative B, the NPS considers allowing stocking to continue in certain mountain lakes and also considers removing fish from certain mountain lakes through various treatment methods.

The results of the minimum requirements analysis show that removal of self-sustaining (reproducing) nonnative fish populations is necessary to help reestablish the historically fishless conditions of lakes in the Steven T. Mather Wilderness, and that stocking of nonnative fish to create and enhance an artificial recreational fishery is not necessary to meet the minimum requirements for the administration of the Stephen T. Mather Wilderness (see appendix K). This conclusion is based upon the well-documented impacts on ecosystem functions and values that result from introducing nonnative fish into mountain lake ecosystems that were historically fishless. Stocking naturally fishless lakes, even with nonreproducing trout, would not leave the wilderness “ideally free from human control or manipulation.” Stocking of fish would manipulate the native ecology of a lake and introduce a nonnative species for the purpose of enhancing recreation.

Some, including the WDFW, disagree with the conclusions reached in the minimum requirements analysis. They maintain that recreational fishing is allowed under the *Wilderness Act*, and therefore, creating and enhancing fishing opportunities are appropriate actions in wilderness areas. Those who disagree with the conclusions reached in the minimum requirements analysis also believe that if nonnative fish were stocked appropriately, there would be no unacceptable adverse impacts on wilderness values because biological integrity would be conserved. For a detailed discussion of the minimum requirements process, refer to the alternative A section titled, “Minimum Requirements.”

PROPOSED FISHERY MANAGEMENT PROGRAM

Proposed Management Framework

The proposed management framework under alternative B would be to eliminate high densities of reproducing fish populations from lakes in the study area while allowing low densities of reproducing and nonreproducing fish populations. Management actions would be applied to the 91 study area lakes throughout the North Cascades Complex. The restocking of nonreproducing fish would be allowed only where impacts on biological resources could be minimized. Based on the best available science, some lakes could be restocked with low densities of nonreproducing fish once reproducing fish have been removed. Lakes where critical information is missing would not be stocked until that information becomes available. An extensive monitoring program (see appendix F) would be implemented to adjust future management and to avoid unacceptable effects on native biota from fish presence.

Proposed Stocking Program

Fish stocking would only continue in lakes where biological integrity could be conserved according to the principles described in table 2. This would be accomplished by stocking with low densities of nonreproducing fish. The lakes that would be stocked under alternative B are shown in table 5. In determining which lakes to stock, the Technical Advisory Committee applied the information contained in tables 1–3, among other data, to develop the management actions described in table 4. From this information, the committee then applied a management action to each of the 91 lakes under alternative B, as shown in table 5. Fish density (high/low) and fish status (reproducing/nonreproducing) were important factors in determining which lakes would be stocked (see appendix E). For example, some lakes with a high density of reproducing fish would have reproducing fish removed, and further information on the lake would be collected prior to considering the lakes for restocking with nonreproducing fish. Or, other lakes with a high density of reproducing fish would become fishless, if feasible, in order to allow native species to recover in a lake that is part of a series of lakes that currently contain fish.

Lakes that would continue to be stocked with no other constraints are identified by management action 4C. Some lakes would be restocked after fish removal (provided reproducing fish populations could be removed), and subsequent monitoring data indicated that the abundance and diversity of native organisms could be conserved. These lakes are identified by management action 2B. The lakes identified by management action 2C would be restocked following removal of reproducing fish populations and a resting period for recovery of native organisms. Stocking would be discontinued for some lakes that are currently stocked because there is not enough information to support continued stocking with the assurance that biological integrity would be conserved. These lakes would be evaluated in accordance with management action 4B (table 4 provides a description of the management actions).

Proposed Stocking Practices

Stocking practices would be the same as alternative A.

Proposed Species and Strains of Fish to be Stocked, Stocking Cycles, and Stocking Densities. The species and strains of fish to be stocked, stocking cycles, and proposed stocking densities are displayed in table 6. Based on monitoring and adaptive management, the following may change: species and strains of fish to be stocked, stocking cycles, and densities stocked. Any species of fish stocked in the future would be nonreproducing.

Specific Times of Year Proposed for Stocking. As in alternative A, the high-elevation lakes proposed for stocking under alternative B would be stocked during the ice-free period, which varies from year to year, but is generally between mid-July to mid-September. Stocking can start as early as May in lower-elevation lakes or as late as the end of October in higher-elevation lakes that ice-out later.

Proposed Stocking Methods. Lakes would be stocked either from the ground via backpack or from the air via fixed-wing aircraft. Whenever feasible, backpack stocking would be the preferred stocking method to minimize impacts on wilderness values. Under the backpack stocking method, WDFW personnel or approved volunteers would carry fry in plastic containers into the lake and release the fish by hand. Fixed-wing aircraft would be used for larger, remote lakes because it is difficult to keep fry alive in backpacks for extended periods, and lengthy travel times can increase fry mortality. The aircraft would be equipped with specialized chambers to carry fish. To ensure the correct lakes would be stocked, Global Positioning System (GPS) instrumentation and skilled, experienced personnel would be used to navigate to target lakes. Lakes would only be stocked under favorable weather conditions, and only lakes greater than 5 acres would be stocked by aircraft (WDFW 2001).

Under alternative B, at least 29 lakes would be backpack stocked, and as many as 12 lakes would be stocked with fixed-wing aircraft following a minimum tool evaluation. Table 11 shows the methods that would be used for stocking each lake under alternatives B and C and the methods currently used under alternative A.

PROPOSED LAKE TREATMENTS TO MANAGE THE FISHERY

The methods of removing fish are discussed above in the "Elements Common to All Action Alternatives" section. The proposed treatment methods to remove fish in specific lakes are given in tables 7 and 9.

PROPOSED MITIGATION

See appendix I for a description of proposed mitigation practices that would be used under this alternative to minimize potential impacts of fish stocking and lake treatment methods.

PROPOSED MONITORING PROGRAM

While priorities for monitoring and evaluation may change across alternatives, the basic monitoring program is common to all action alternatives. A description of the proposed monitoring program can be found in appendix F.

COST OF IMPLEMENTATION

The total costs of implementing alternative B are estimated to be \$2.14 million over the next 15 years. The bulk of these costs would be associated with fish removal actions. For a detailed explanation of program costs under alternative B, see the "Management and Operations" section in the "Environmental Consequences" chapter.

Fixed-wing aircraft would be used to stock the larger, remote lakes.

TABLE 11: METHODS USED FOR TRANSPORTING FISH TO LAKES STOCKED UNDER ALTERNATIVES A, B, AND C

	Method Used to Transport Fry	Method that Would be Used to Transport Fry[a]	
Lake Name	**Alternative A**	**Alternative B**	**Alternative C**
Battalion	Backpack, fixed-wing aircraft	Backpack	Backpack
Berdeen	Fixed-wing aircraft	Fixed-wing aircraft	NA[b]
Blum (Lower/West No. 4)	Reproducing fish present[c]	Backpack	NA
Bear	Reproducing fish present[c]	Fixed-wing aircraft	NA
Blum (Largest/Middle, No. 3)	Backpack, fixed-wing aircraft; unknown	NA	NA
Bouck, Lower	Reproducing fish present[c]	Fixed-wing aircraft	Fixed-wing aircraft
Bouck, Upper	Backpack	NA	NA
Bowan	Backpack	NA	NA
Coon	Fixed-wing aircraft; unknown	Backpack or stock (e.g., horse)	Backpack or stock (e.g., horse)
Copper[d, e]	Fixed-wing aircraft; unknown	Backpack	NA
Dagger	Backpack	Backpack or stock (e.g., horse)	NA
Dee Dee, Upper	Backpack	Backpack	NA
Doubtful	Reproducing fish present[c]	Fixed-wing aircraft	NA
Diobsud No. 2	Backpack, fixed-wing aircraft	Backpack	NA
Diobsud No. 3, Upper	Backpack, fixed-wing aircraft; unknown	NA	NA
Doug's Tarn	Reproducing fish present[c]	Backpack	NA
Green	Reproducing fish present[c]	Fixed-wing aircraft	NA
Firn	Backpack, fixed-wing aircraft	NA	NA
Hidden	Backpack, fixed-wing aircraft; Unknown	Backpack or fixed-wing aircraft	NA
Hidden Lake Tarn	Backpack	NA	NA
Hozomeen	Fixed-wing aircraft	NA	NA
Hi-Yu[d]	Backpack, unknown	Backpack	NA
Jeanita	Backpack, unknown	NA	NA
Kwahnesum	Backpack, fixed-wing aircraft	NA	NA
McAlester	Fixed-wing aircraft	Backpack or stock (e.g., horse)	Backpack or stock (e.g., horse)
Monogram	Backpack, fixed-wing aircraft; unknown	Backpack or fixed-wing aircraft	NA
Nert	Backpack, unknown	NA	NA
No Name	Backpack, unknown	Backpack	NA
Panther Potholes (Lower)	Backpack, fixed-wing aircraft	NA	NA
Pond SE of Kettling Lakes	Backpack	Backpack	Backpack
Quill, Lower[d]	Backpack	Backpack	NA
Quill, Upper[d]	Backpack	Backpack	NA
Rainbow	Unknown	Backpack or stock (e.g., horse)	Backpack
Rainbow, Upper (West)	Backpack, fixed-wing aircraft	NA	NA

TABLE 11: METHODS USED FOR TRANSPORTING FISH TO LAKES STOCKED UNDER ALTERNATIVES A, B, AND C (CONTINUED)

	Method Used to Transport Fry	Method that Would be Used to Transport Fry[a]	
Lake Name	**Alternative A**	**Alternative B**	**Alternative C**
Rainbow, Upper, (South)	Backpack, fixed-wing aircraft; unknown	NA	NA
Ridley	Backpack	Backpack	Backpack
Skymo	Backpack, fixed-wing aircraft; unknown	Backpack or fixed-wing aircraft	NA
Sourdough	Fixed-wing aircraft; unknown	Fixed-wing aircraft	NA
Stiletto[d]	Backpack, fixed-wing aircraft	Backpack	NA
Stout	Backpack, unknown	NA	NA
Stout, Lower	Reproducing fish present[c]	NA	NA
Sweet Pea	Backpack, unknown	Backpack	NA
Thornton, Lower	Backpack, fixed-wing aircraft, unknown	Backpack or fixed-wing aircraft	NA
Thornton, Middle	Backpack, unknown	Backpack or fixed-wing aircraft	NA
Torment	Backpack	NA	NA
Trapper	Reproducing fish present[c]	Backpack or fixed-wing aircraft	NA
Triplet, Lower	Reproducing fish present[c]	Backpack	Backpack
Triplet, Upper	Reproducing fish present[c]	NA	NA
Triumph	Backpack	Backpack	NA
Unnamed (MR -11-01)	Backpack	Backpack	Backpack
Unnamed (MR-16-01)	Reproducing fish present[c]	NA	NA
Wilcox/Sandie, Lower	Reproducing fish present[c]	Backpack	NA
Willow	Backpack, fixed-wing aircraft, unknown	Backpack	Backpack

Notes:

The surface area and other details about the 91 lakes can be found in appendix E.

Stocking densities and cycles can be found in table 6 and appendix E.

a. The final determination of whether to transport fish to lakes using backpacks, stock (e.g., horses), or fixed-wing aircraft is a minimum tool-related issue that would be determined when the NPS completes the minimum tool analysis as part of the record of decision on this plan/EIS. Backpack or stock (e.g., horses) would be preferred over fixed-wing aircraft unless a lake were too large, remote, or otherwise inaccessible.

b. “NA” means the lake would not be available for stocking.

c. Reproducing fish present, but stocking has not occurred in the recent past.

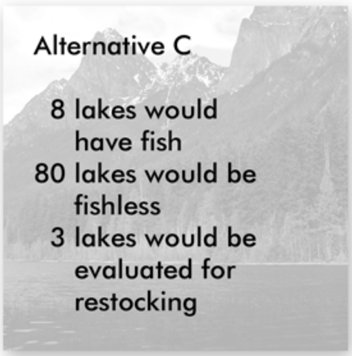
d. The decision about continued stocking of these lakes is pending further data collection and evaluation.

e. In August 2004, a large fish kill was observed in Copper Lake, possibly due to disease. Further surveys are needed to confirm that the lake is fishless.

ALTERNATIVE C

PROPOSED ADAPTIVE MANAGEMENT OF 91 LAKES UNDER A NEW FRAMEWORK (11 LAKES MAY HAVE FISH)

GENERAL CONCEPT



Alternative C applies a new management framework to the 22 lakes in the study area, wherein 9 lakes in Ross Lake and Lake Chelan National Recreation Areas would have fish, and 2 lakes would be evaluated for restocking. Of the other 11 lakes in the national recreation areas, 3 would remain fishless, 3 would have high-density reproducing fish removed, and stocking would be discontinued in 5 lakes. The remaining 69 lakes are in the national park portion of the North Cascades Complex and would be returned to their natural fishless condition or would remain fishless.

While NPS policy states that in general, "exotic species will not be introduced into parks" (NPS 2001a, 4.4.3), policies also state:

> In some situations, the Park Service may stock native or exotic animals for recreational harvesting purposes, but only when such stocking will not impair park natural resources or processes, and:
>
> - The stocking is of fish into constructed large reservoirs or other significantly altered large water bodies and the purpose is to provide for recreational fishing; or
> - Such stocking is in a national recreation area or preserve that has historically been stocked (in these situations, stocking only of the same species may be continued); or
> - Congressional intent for stocking is expressed in statute or a House or Senate report accompanying a statute.
>
> The Service will not stock waters that are naturally barren of harvested aquatic species.

Within the national recreation areas, fish would remain in lakes where a low density of reproducing or nonreproducing fish populations would not have unacceptable effects on native biological resources. It may not be feasible to remove reproducing populations of fish in the 9 larger, deeper lakes identified in table 7 (1 of these is in a national recreation area), so these lakes would continue to provide residual sport-fishing opportunities for the foreseeable future, and the goal of complete removal might never be achieved.

The adaptive management actions, discussed previously under "Adaptive Management" in the "Elements Common to All Action Alternatives" section, have been summarized for alternative C in table 12 and figure 7. For a listing of management actions by lake under alternative C, refer to table 5; for the current status and condition of the 91 lakes, refer to appendix E.

TABLE 12: PROPOSED MANAGEMENT ACTIONS FOR ALTERNATIVE C

Management Action (number)[a]	Number of Lakes	
Lakes that would continue to have fish under alternative C[b,c]		
	Inside a national recreation area	Inside the national park
Continue to stock with nonreproducing fish (4C)	5	0
Remove reproducing fish, allow lake to rest, and restock with nonreproducing fish (2C)	3	0
Evaluate reproductive status of fish, allow low densities of fish (reproducing or nonreproducing) (3B)	1	0
Supplement the low densities of reproducing fish presently in the lake with stocked nonreproducing fish (3C)	0	0
Subtotal	**9**	**0**
Lakes that would become or be maintained fishless under alternative C		
	Inside a national recreation area	Inside the national park
Discontinue stocking of lake (nonreproducing) (4A)	5	16
Treat lakes to remove low- density reproducing fish (3A)	0	8
Treat lakes to remove high-density reproducing fish (2A)	3	19
Maintain as fishless (1)	3	26
Subtotal	**11**	**69**
Lakes to be evaluated prior to determining management action under alternative C		
	Inside a national recreation area	Inside the national park
Discontinue stocking lake, gather information, determine if lake should be restocked (4B)	0	0
Remove reproducing fish, gather information, determine if lake should be restocked (2B)	2	0
Subtotal	**2**	**0**
	Inside a national recreation area	Inside the national park
Grand Total	**22**	**69**

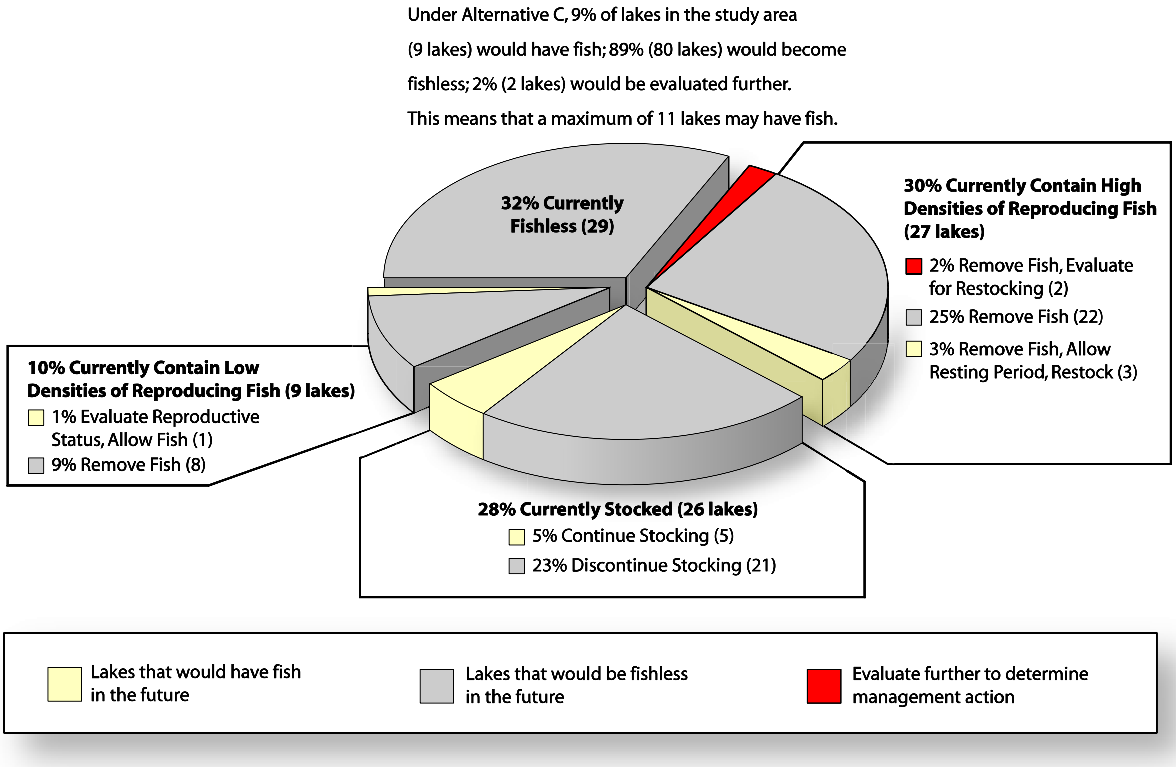
Notes:

a. For a full description, see the “Management Actions” section and tables 4 and 5 in this chapter.

b. These lakes would have fish based on the management action as first applied. For some, if monitoring indicates a problem, the availability may be reduced in the future.

c. The possible future outcome of alternative C would be that 11 lakes may have fish, which is the total of 9 lakes that would continue to have fish, combined with the 2 lakes that would be evaluated to determine if they should be restocked.

FIGURE 7: STATUS OF 91 LAKES UNDER ALTERNATIVE C



IMPLEMENTING THE FISHERY MANAGEMENT PLAN THROUGH CONGRESSIONAL ACTION

Under alternative C (as in alternatives A and B), in order to continue stocking lakes in the North Cascades Complex (only select national recreation area lakes would be stocked under alternative C), the NPS would seek congressional action to provide clarification of the enabling legislation for the North Cascades Complex. Refer to "Implementing the Fishery Management Plan through Congressional Action" in the description of alternative A that was presented earlier in this chapter. Congressional action to clarify the intent in the enabling legislation for the North Cascades Complex to allow for continued fish stocking would set a precedent for this NPS unit and possibly others that have, or may have in the future, fish stocking issues.

MINIMUM REQUIREMENTS

Under alternative C, the NPS considers allowing stocking to continue in certain mountain lakes and also considers removing fish from certain mountain lakes through various treatment methods.

The results of the minimum requirements analysis show that removal of self-sustaining (reproducing) nonnative populations of fish is necessary to help reestablish the historically fishless conditions of lakes in the Steven T. Mather Wilderness, and that stocking of nonnative fish to create and enhance an artificial recreational fishery is not necessary to meet the minimum requirements for the administration of the Stephen T. Mather Wilderness (see appendix K). This conclusion is based upon the well-documented impacts on ecosystem functions and values that result from introducing nonnative fish into mountain lake ecosystems that were historically fishless. Stocking naturally fishless lakes, even with nonreproducing trout, would not leave the wilderness “ideally free from human control or manipulation.” Stocking of fish would manipulate the native ecology of a lake and introduce a nonnative species for the purpose of enhancing recreation.

Some, including the WDFW, disagree with the conclusions reached in the minimum requirements analysis. They maintain that recreational fishing is allowed under the *Wilderness Act*, and therefore, creating and enhancing fishing opportunities is an appropriate action in wilderness areas. Those who disagree with the conclusions reached in the minimum requirements analysis also believe that if nonnative fish were stocked appropriately, there would be no unacceptable adverse impacts on wilderness values because biological integrity would be conserved. For a detailed discussion of the minimum requirements process, refer to the alternative A section titled, “Minimum Requirements.”

PROPOSED FISHERY MANAGEMENT PROGRAM

Proposed Management Framework

The proposed management framework under alternative C would be to eliminate or reduce reproducing fish from lakes in the national recreation areas because high densities of reproducing fish populations can alter the lake ecosystem and negatively effect native biota. Restocking of nonreproducing fish would be allowed only where biological resources could be protected in lakes located in the national recreation areas. Based on best available science, some lakes could be restocked with nonreproducing fish at low densities once reproducing fish have been removed. Where critical information is missing, lakes would not be stocked until such information becomes available. A monitoring program (see appendix F) would be incorporated to adjust future management actions in order to avoid unacceptable effects on native biota from fish presence. The remaining 69 lakes in the national park portion of the North Cascades Complex either would remain fishless or become fishless.

Proposed Stocking Program

The proposed stocking program under alternative C would differ from alternative B in that only lakes in the national recreation areas would be eligible for stocking. No lakes in the national park would be stocked. The lakes that would be stocked under alternative C are shown in table 5. As with alternative B, the Technical Advisory Committee determined which lakes to stock by applying the information contained in tables 1–3, among other data, to develop the management actions described in table 4. From this information, the committee then applied a management action to each of the 91 lakes under alternative C, as shown in table 5.

Fish density (high/low) and fish status (reproducing/nonreproducing) were important factors in determining which lakes would be stocked (refer to table 5 and appendix E). For example, Hozomeen and Upper Triplet lakes contain high densities of reproducing fish. Under alternative C, the 2 lakes would become fishless in order to allow native species to recover in a lake that is part of a series of lakes where some would contain fish. In 2 other lakes, the high-density reproducing fish would be removed, and further information on the lake would be collected prior to considering the lake for restocking of nonreproducing fish.

The 3 lakes in the national recreation areas that are currently fishless would remain fishless in order to allow these lakes to revert to pre-stocking conditions and/or maintain natural communities without influence from fish. The 26 lakes in the national park that are currently fishless would also remain fishless.

Management of Lakes in the National Park

There are 69 lakes in the national park; of these 69 lakes, 26 that are currently fishless would remain fishless, 16 lakes that are currently stocked would cease to be stocked, and 27 lakes would be treated to remove reproducing fish.

Proposed Stocking Practices

Stocking practices would be the same as alternative A.

Proposed Species and Strains of Fish to be Stocked, Stocking Cycles, and Densities. The species and strains of fish to be stocked, stocking cycles, and proposed stocking densities are displayed in table 6. Based on monitoring and adaptive management, the following may change: species and strains of fish to be stocked and stocking cycles and densities. Any species of fish stocked in the future would be nonreproducing.

Specific Times of Year Proposed for Stocking. As in alternative A, the mountain lakes proposed for stocking under alternative C would be stocked during the ice-free period, which varies from year to year, but is generally between mid-July to mid-September. Stocking can start as early as May in lower-elevation lakes or as late as the end of October in higher-elevation lakes that ice-out later.

Stocking Methods. Under alternative C, 9 lakes would be stocked via backpacks, and 1 lake would be stocked via fixed-wing aircraft following a minimum-tool evaluation. Table 11 shows the methods that would be used for stocking each lake under alternatives B and C and the methods currently used under alternative A.

Proposed Lake Treatments to Manage the Fishery

Under alternative C, of the 22 lakes located in the national recreation areas, fish would be removed from 15 lakes. Some of these 15 lakes would be candidates for restocking, and some would remain fishless. Of the remaining 69 lakes located in the national park, 43 lakes would be actively managed to return to a fishless condition, and 26 lakes would be maintained in their fishless state. The methods of removing fish are discussed above in the "Elements Common to All Action Alternatives" section. The treatment methods proposed for specific lakes are given in tables 7 and 9.

Proposed Mitigation

See appendix I for a description of proposed mitigation practices that would be used under this alternative to minimize potential impacts of fish stocking and lake treatment methods.

Proposed Monitoring Program

While priorities for monitoring and evaluation may change across alternatives, the basic monitoring program is common to all action alternatives. A description of the proposed monitoring program can be found in appendix F.

Cost of Implementation

The total costs of implementing alternative C are estimated at $2.84 million over the next 15 years. The bulk of these costs would be associated with fish removal actions. For a detailed explanation of program costs under alternative C, see the "Management and Operations" section in the "Environmental Consequences" chapter.

ALTERNATIVE D

91 LAKES WOULD BE FISHLESS (ENVIRONMENTALLY PREFERRED ALTERNATIVE)

GENERAL CONCEPT

Alternative D represents 91 lakes in the North Cascades Complex that currently have fish as a result of either a documented or an undocumented history of fish stocking, in addition to those lakes that are currently fishless. The emphasis of this alternative would be to eliminate all fish from mountain lakes in the study area. For the current status and condition of the 91 lakes, see table 5 and appendix E.

Currently, 62 of the 91 study area lakes have fish and 29 are fishless. Under alternative D, four management actions would be available for a given lake. These management actions, discussed previously in the "Management Actions" section of this chapter, have been summarized in table 13.

TABLE 13: PROPOSED MANAGEMENT ACTIONS FOR ALTERNATIVE D

Management Action (number)*	Number of Lakes
Lakes become fishless or be maintained fishless under alternative D	
Discontinue stocking (nonreproducing) (4A)	26
Treat lakes to remove low-density reproducing fish (3A)	9
Treat lakes to remove high-density reproducing fish (2A)	27
Maintain as fishless (1)	29
Grand Total	**91**

Note:

* For a full description, see the "Management Actions" section in this chapter.

IMPLEMENTING THE FISHERY MANAGEMENT PLAN THROUGH CONGRESSIONAL ACTION

This alternative would not require congressional action to clarify the North Cascades Complex's enabling legislation.

MINIMUM REQUIREMENTS

Under alternative D, the NPS considers discontinuing stocking and removing fish from certain mountain lakes through various methods. The results of the minimum requirements analysis show that removal of self-sustaining (reproducing) nonnative populations of fish is necessary to help reestablish the historically fishless conditions of lakes in the Steven T. Mather Wilderness (see appendix K). For a detailed discussion of the minimum requirements process, refer to the alternative A section titled, "Minimum Requirements."

PROPOSED FISHERY MANAGEMENT PROGRAM

PROPOSED MANAGEMENT FRAMEWORK

The goal for alternative D is that all 91 study area lakes would be fishless: 29 currently fishless lakes would remain fishless and 62 would be returned to a fishless condition. Stocking would be discontinued in all lakes currently stocked and the stocked fish would die off within several years. After five years, the quality of sport-fishing opportunities in most of these lakes may decline due to fish mortality and removal from angling pressure (WDFW, M. Downen, pers. comm., 2004). Reproducing populations of fish would be gradually removed over time. The rate of removal would depend upon the availability of resources (funding and personnel) and differences among methods of removal. It may not be feasible to remove reproducing populations of fish in the nine larger, deeper lakes identified in table 7, so these lakes would continue to provide residual sport-fishing opportunities for the foreseeable future, and the goal of complete removal might never be achieved.

Alternative D is most closely aligned with the current *NPS Management Policies* (NPS 2001a, 4.4.4.1), which state that, in general, “exotic species will not be introduced into parks.” The NPS is instructed to not intervene in natural biological or physical processes, except in emergency situations to restore natural ecosystem functioning that has been disrupted by past human activities, when specifically directed by Congress, or when a park plan has identified the intervention as necessary to protect other park resources (NPS 2001a, 4.1). Section 4.1.5 of *NPS Management Policies* states: “[t]he Service will re-establish natural functions and processes in human-disturbed components of natural systems in parks unless otherwise directed by Congress,” and “Impacts to natural systems resulting from human disturbances include the introduction of exotic species.” The *NPS Management Policies*, section 6.3.7, Natural Resources Management in Wilderness, states:

> The principle of non-degradation will be applied to wilderness management, and each wilderness area’s condition will be measured and assessed against its own unimpaired standard. Natural processes will be allowed, insofar as possible, to shape and control wilderness ecosystems. Management should seek to sustain the natural distribution, numbers, population composition, and interaction of indigenous species. Management intervention should only be undertaken to the extent necessary to correct past mistakes, the impacts of human use, and influences originating outside of wilderness boundaries.

Alternative D was crafted to meet the spirit and intent of *NPS Management Policies* by discontinuing stocking and eventually removing reproducing fish populations from mountain lakes wherever feasible. Alternative D also provides a basis for comparing the effects of the no-action alternative (alternative A) and the other action alternatives.

PROPOSED STOCKING PROGRAM

The intent of this alternative is that all mountain lakes in the national park and national recreation areas would eventually be fishless. To accomplish this, stocking would no longer occur in any of the lakes in the North Cascades Complex, and reproducing populations of fish would be systematically removed wherever feasible (see tables 7 and 9).

Proposed Stocking Practices

No fish would be stocked in lakes in the study area.

Proposed Species and Strains of Fish to be Stocked, Stocking Cycles, and Densities. No fish would be stocked in lakes in the study area.

Specific Times of Year Proposed for Stocking. No fish would be stocked in lakes in the study area.

Proposed Stocking Methods. No fish would be stocked in lakes in the study area.

PROPOSED LAKE TREATMENTS TO MANAGE THE FISHERY

Under alternative D, fish would be removed from 62 of the 91 lakes in the study area, and the 29 lakes that are currently fishless would remain fishless. The methods of removing fish are discussed above in “Elements Common to All Action Alternatives.” The treatment methods proposed for specific lakes are given in tables 7 and 9.

The long-term result would be that no mountain lakes would contain fish once all lakes were treated to remove reproducing fish populations; however, until lakes were treated, reproducing fish populations would persist. In spite of the goal of making all lakes fishless, complete removal might not prove feasible, especially from some of the larger, deeper lakes in the study area.

PROPOSED MITIGATION

See appendix I for a description of proposed mitigation practices that would be used under this alternative to minimize potential impacts of lake treatment methods.

PROPOSED MONITORING PROGRAM

While priorities for monitoring and evaluation may change across alternatives, the basic monitoring program is common to all action alternatives. A description of the proposed monitoring program can be found in appendix F.

COST OF IMPLEMENTATION

The costs of implementing alternative D are estimated to be $3 million over the next 15 years and potentially longer depending on feasibility of complete removal and funding availability. For a detailed explanation of program costs under alternative D, see the “Management and Operations” section in the “Environmental Consequences” chapter.

HOW ALTERNATIVES MEET OBJECTIVES

As stated in the “Purpose of and Need for Action” chapter, all action alternatives selected for analysis must meet all objectives to a large degree. The action alternatives must also address the stated purpose of taking action and resolve the need for action; therefore, the alternatives, and the effects they would have on the lakes in the study area, were individually assessed in light of how well they would meet the objectives for this plan/EIS. Alternatives that did not meet the plan/EIS objectives were not analyzed further (see the “Alternatives Eliminated from Further Consideration” section in this chapter).

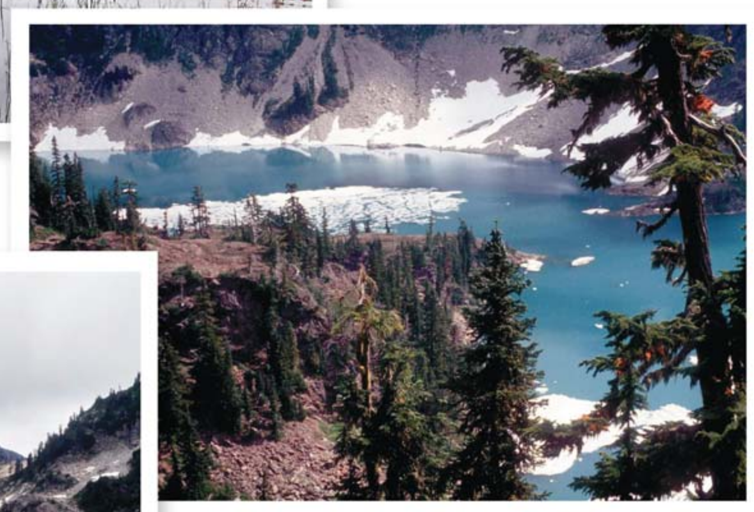
The plan’s objectives are to

> Obtain support from interested parties and groups to implement a new management plan for mountain lakes in the North Cascades Complex should the governing agencies decide a new plan is needed.
>
> Advance the protection and rehabilitation of native biological integrity by maintaining native species abundance, viability, and sustainability.
>
> Provide a spectrum of recreational opportunities, including sport fishing, while minimizing impacts to the biological integrity of natural mountain lakes.
>
> Apply science and research in decision-making at multiple spatial scales that include landscape, watershed, lake cluster, and individual lakes.
>
> Provide to the public and interested parties full and open access to available information.

While each action alternative seeks to protect the biological resources of the lakes in the study area, each action alternative would also provide varying degrees of recreational opportunities, including sport fishing. Even alternative D (91 Lakes Would Be Fishless) would provide sport-fishing opportunities in mountain lakes for a lengthy period because it would take many years to remove all reproducing fish populations from the mountain lakes. If it is not feasible to completely remove fish from larger, deeper lakes, fish densities would be reduced, and these lakes could provide sport-fishing opportunities indefinitely (refer to tables 7 and 8).

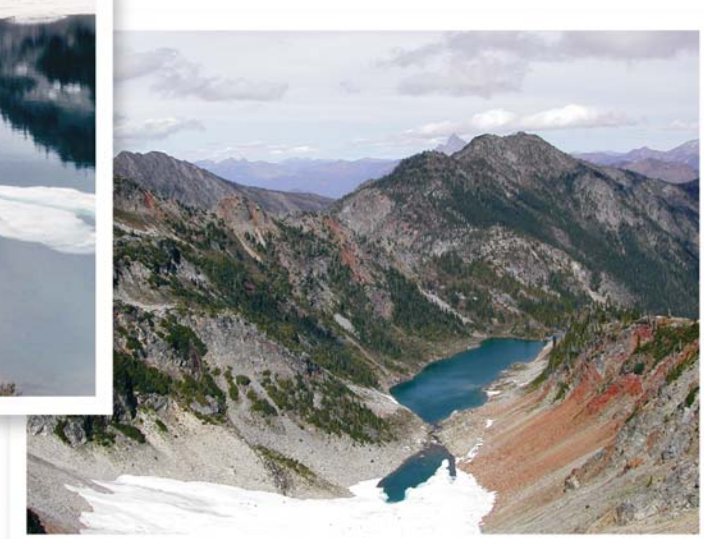
Table 14 summarizes the elements of the alternatives being considered. The "Environmental Consequences" chapter describes the effects on each impact topic under each of the alternatives, including the impact on recreational values and visitor experience. These impacts are summarized in "Table 15: Summary of Environmental Consequences." "Table 16: Analysis of How the Alternatives Meet Objectives," compares how each of the alternatives described in this chapter would meet the objectives for this plan/EIS. (Tables 14, 15, and 16 are located at the end of this chapter.)

Ridley Lake



Berdeen Lake (south end)

Berdeen Lake (from the outlet)



Skymo Lake

ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

The four alternatives described below were eliminated from further consideration.

Cease stocking in all lakes or in a portion of the lakes in the study area, but do not actively return lakes with reproducing fish to fishless conditions. Based on clear conclusions in reports from the U.S. Geological Survey (refer to the “Purpose of and Need for Action” chapter), high densities of fish often caused by uncontrolled reproducing fish populations were recognized as having the greatest adverse impacts on the native biota and ecosystems of mountain lakes in the North Cascades Complex. Consequently, this alternative was not deemed reasonable or selectable as an alternative and was not carried through full impact analysis.

Cease stocking in all or a portion of the lakes in the study area and return lakes to fishless conditions using solely passive methods (that is, natural lake treatment as defined in this plan/EIS). With the understanding that passive methods of removing fish from lakes could take many years, it was recognized that more expedient methods of fish removal would be desired in many cases due to the potential of ongoing, long-term adverse impacts on the native biota and ecosystems of mountain lakes in the North Cascades Complex.

Use biological treatment methods to remove fish from lakes. The use of biological controls using a sterile “apex” predator to remove fish from lakes as an element of an alternative was considered but rejected. Biological controls, such as the tiger muskellunge, were rejected because of a lack of case studies demonstrating success and because of the concern for unintended consequences to native species, including predation on nontarget organisms such as macroinvertebrates.

Provide sport fishing opportunities by stocking some of the 154 mountain lakes that have never had any fish presence. The 1985 Memorandum of Understanding between the NPS and WDFW was entered into in order to resolve differences in policy regarding fish stocking between the two agencies. The 1988 Supplemental Agreement to the Memorandum of Understanding identified as appropriate for fish stocking, 40 lakes in the national park that either have a history of fish stocking or have reproducing fish populations. This plan/EIS focuses on those 40 lakes, and the other 51 mountain lakes in the North Cascades Complex that have a history of fish presence; 29 of the 91 lakes are currently fishless. This plan/EIS did not contemplate stocking any of the 29 currently fishless lakes because both the NPS and WDFW assumed that if the lakes have gone fishless, they are undergoing a natural recovery process that should not be interfered with. The 154 mountain lakes in the North Cascades Complex have never had a presence of fish, and neither the NPS nor the WDFW advocate stocking any of those lakes. Consequently, an alternative that considered stocking currently fishless lakes outside of the 91 was not deemed a reasonable alternative.

CONSISTENCY WITH SECTIONS 101(B) AND 102(1) OF THE NATIONAL ENVIRONMENTAL POLICY ACT

The NPS requirements for implementing NEPA include an analysis of how each alternative meets or achieves the purposes of NEPA, as stated in sections 101(b) and 102(1). Each alternative analyzed in a NEPA document must be assessed as to how it meets the following purposes:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
2. Ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings.
3. Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
4. Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
5. Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.
6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Council on Environmental Quality Regulation 1500.2 establishes policy for federal agencies' implementation of NEPA. Federal agencies shall, to the fullest extent possible, interpret and administer the policies, regulations, and public laws of the United States in accordance with the policies set forth in NEPA (sections 101(b) and 102(1)); therefore, other acts and NPS policies are referenced as applicable in the following discussion. In addition, *NPS Management Policies* address the application of NEPA to wilderness planning (NPS 2001a, 6.3.4.3).

Alternative A—No Action, Existing Management Framework of 91 Lakes (62 Lakes Have Fish). This alternative partially meets the purposes because it currently provides for angling, a recreational use in the North Cascades Complex for approximately 1,000 mountain lake anglers per year (see "Methodology and Assumptions" in the "Visitor Use and Experience" section in the "Environmental Consequences" chapter). The stocking of fish in the mountain lakes is considered, by some, to be a renewable resource that provides a beneficial use for a portion of visitors to the North Cascades Complex. This use is highly treasured by the angling community, especially in light of the history of the fishery and its potential value to future generations. Alternative A does, however, involve continued risk and some unintended and undesirable consequences to the environment. As discussed in the "Environmental Consequences" chapter, alternative A would continue to cause impacts on native aquatic organisms, threatened and endangered species, sensitive vegetation, and wilderness values. These impacts are primarily associated with the current fishery management program that allows for continued existence of reproducing fish in naturally fishless lakes.

Alternative B, Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish), Preferred Alternative. This alternative meets the purposes overall, to some degree, and only partially meets purpose four with respect to preserving a cultural aspect of our heritage (high-lakes fishing) and with respect to individual choice. Some lakes would be available for fishing opportunities and some lakes would not, hence precluding opportunities and individual choice for some anglers. Alternative B would achieve a balance between population and resource use because it includes an adaptive management component (see the description of adaptive management in the "Elements Common to All Action Alternatives" section in this chapter). As discussed in the "Environmental Consequences" chapter, alternative B proposes to conserve biological integrity in lakes by eliminating or reducing reproducing fish populations. Elimination of reproducing fish populations would entail using various mechanical and chemical lake treatment methods, which may have unintended consequences; therefore, a small number of lakes would be treated and monitored in order to adjust the applied fish removal methods, if necessary. Select lakes would be stocked with low densities of fish that would not be capable of reproduction in order to prevent reestablishment of reproducing populations. Stocked fish would be native to the basin or incapable of reproduction to minimize potential downstream impacts. With these measures, alternative B meets the first purpose to a large degree; that is, it fulfills the responsibilities of each generation as trustee of the environment for succeeding generations given that fish stocking would only occur when long-term impacts on the environment could be avoided or minimized. However, because alternative B proposes to continue a fish stocking program in naturally fishless lakes in the North Cascades Complex, it is not totally consistent with *NPS Management Policies* (NPS 2001a), which seek to preserve native biota and conserve biological integrity. Alternative B may also be viewed by some as inconsistent with the *Wilderness Act* because it continues a practice of fish stocking and human influence in a designated wilderness area.

Alternative C, Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish). This alternative meets all six purposes to some degree and only partially meets purpose four with respect to preserving a cultural aspect of our heritage (high-lakes fishing) and with respect to individual choice. Some lakes in the national recreation areas would be available for fishing and some lakes would not, hence precluding opportunities and individual choice for some anglers. Nine lakes in Ross Lake and Lake Chelan National Recreation Areas would have fish, and 2 lakes would be evaluated for restocking. Of the other 11 lakes in the national recreation areas, 3 would remain fishless, 3 would have high-density reproducing fish removed, and stocking would be discontinued in 5 lakes. The remaining

69 lakes are in the national park portion of the North Cascades Complex and would be returned to their natural fishless condition or would remain fishless. Similar to alternative B, some angling opportunities would be available but only in the mountain lakes located in the two national recreation areas. Alternative C would meet purpose four to a large degree because it would preserve important resources in the North Cascades Complex by returning a select number of mountain lakes to a fishless condition while maintaining a diversity of visitor experiences and variety of individual choices. With adaptive management practices applied to the lakes in the two national recreation areas, stocking would be allowed only if long-term impacts on the environment could be avoided or minimized. Some still may view fish stocking in the national recreation areas to be inconsistent with *NPS Management Policies* and the *Wilderness Act* because some of those lakes were naturally fishless, and human influences would continue in the Stephen T. Mather Wilderness.

Alternative D (91 Lakes Would be Fishless). This alternative meets the stated purposes of NEPA sections 101(b) and 102(1) to a large degree. This alternative only partially meets purpose four with respect to preserving a cultural aspect of our heritage (high-lakes fishing) and with respect to individual choice. Some lakes would be available for fishing in the short term and some lakes would not, hence precluding opportunities and individual choice for some anglers. The intent of this alternative is that all mountain lakes in the national park and national recreation areas would eventually be fishless, although nine lakes have been identified where complete fish removal may not be feasible (see table 7). Alternative D also applies adaptive management practices to return lakes to a fishless condition, thus restoring natural processes and conserving biological integrity over the long term. Alternative D would eliminate angling in those lakes with reproducing fish populations, currently stocked lakes, or lakes proposed to be stocked under alternatives B and C; therefore, it does eliminate individual choice for those who value this experience in the national park and two national recreation areas. There would, however, still be fishing opportunities in the reservoirs and streams. After five years, the quality of sport-fishing opportunities in most of the 91 study area lakes may decline due to fish mortality and removal from angling pressure (WDFW, M. Downen, pers. comm., 2004). The rate of removal would depend on resource (funding and personnel) availability and differences among fish removal methods. Complete removal of reproducing fish populations might not be feasible in the nine larger, deeper lakes identified in table 7, and as a result, biological integrity may still be compromised to some degree. These lakes would continue to provide sport-fishing opportunities for the foreseeable future, and the goal of complete removal might never be achieved. There would be short-term consequences of this alternative because it proposes the use of mechanical and chemical methods to remove reproducing fish in a large number of lakes, which could involve impacts and unintended consequences. Treating a small number of lakes and adapting fish removal methods could avoid or minimize these consequences over the long term. Alternative D best meets the intent of *NPS Management Policies* in that it returns lakes to their naturally fishless condition, thereby conserving native biota and ecological processes. Some may also view this alternative as best meeting the requirements of the *Wilderness Act* in that, after returning lakes to a naturally fishless condition, human influences of fish stocking would be eliminated. However, illegal stocking may occur under this alternative.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The NPS is required to identify the environmentally preferred alternative in its NEPA documents for public review and comment. The NPS, in accordance with the Department of the Interior policies contained in the Department Manual (516 DM 4.10) and the Council on Environmental Quality's Forty Questions, defines the environmentally preferred alternative (or alternatives) as the alternative that best promotes the national environmental policy expressed in NEPA (Section 101(b)) (516 DM 4.10). The Council on Environmental Quality's Forty Questions (Q6a) further clarifies the identification of the environmentally preferred alternative stating, "simply put, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and native processes." Alternative D (91 Lakes Would Be Fishless) best protects the biological and physical environment by eliminating the consequences of stocked and reproducing fish populations over the long term. It is acknowledged, however, that angling in the mountain lakes has been a long-standing historic and cultural practice that would be eliminated through implementation of alternative D. The WDFW does not agree that alternative D is the environmentally preferred alternative because it does not strike any balance between protecting biological integrity and preserving historic processes.

TABLE 14: ALTERNATIVES ELEMENTS SUMMARY

Elements	Alternative A (No Action) Existing Management Framework of 91 Lakes (62 Lakes Have Fish)	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless
General Concept				
Lake management	No change in the way the North Cascades Complex fishery is managed. Lakes that are currently stocked would continue to be stocked, lakes with reproducing fish would be allowed to maintain reproducing fish, and all lakes without fish would continue to be fishless.	Manage 91 lakes in the study area that have a fish history from either a documented or undocumented history of fish stocking; the 91 lakes would be managed under a new adaptive management framework, which includes taking action to remove fish from select lakes.	Manage 91 lakes in the study area that have a fish presence from either a documented or undocumented history of fish stocking. 22 lakes are in the two national recreation areas (NRA) would be managed under a new adaptive management framework, which includes taking action to remove fish from some lakes (11 of the 22 NRA lakes may continue to have fish). 69 lakes in the national park either would remain fishless or be returned to fishless conditions.	The 91 lakes in the study area that have a history of fish presence from either documented or undocumented fish stocking would all become fishless over time, and stocking would be eliminated.
Current and Proposed Management				
Current and proposed management for fishless lakes	**Current Management** 29 lakes in the study area are currently fishless, including 3 in the national recreation areas and 26 in the national park.	**Proposed Management** 49 lakes in the study area would remain fishless or be actively returned to fishless conditions.	**Proposed Management** 80 lakes in the study area would remain fishless or be actively returned to fishless conditions; this includes 11 lakes in the national recreation areas and 69 lakes in the national park.	**Proposed Management** 91 lakes in the study area would remain fishless or be actively returned to fishless conditions.
Current and proposed management of lakes with high densities of reproducing fish	**Current Management** 27 lakes currently contain high densities of reproducing fish.	**Proposed Management** No lakes would contain high densities of reproducing fish.	**Proposed Management** No lakes would contain high densities of reproducing fish.	**Proposed Management** No lakes would contain high densities of reproducing fish.

TABLE 14: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Elements	Alternative A (No Action) Existing Management Framework of 91 Lakes (62 Lakes Have Fish)	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless
Current and Proposed Management (continued)				
Current and proposed management of lakes with low-densities of fish (reproducing and nonreproducing)	**Current Management** 9 lakes currently contain low densities of reproducing fish.	**Proposed Management** 7 lakes would contain low densities of reproducing fish.	**Proposed Management** 1 lake in a national recreation area and no lakes in the national park would contain low densities of reproducing fish.	**Proposed Management** No lakes would contain low densities of reproducing fish.
Current and proposed management of lakes with nonreproducing fish	**Current Management** 26 lakes are currently stocked with nonreproducing fish.	**Proposed Management** 22 lakes would have nonreproducing fish.	**Proposed Management** 8 lakes in the national recreation areas would have nonreproducing fish. No lakes in the national park would be stocked.	**Proposed Management** No lakes would have fish.
Current and proposed management of lakes lacking data	**Current Management** No additional data would be needed to make final management action determinations.	**Proposed Management** 13 lakes would be evaluated under a new adaptive management framework prior to determining management action.	**Proposed Management** 2 lakes in the national recreation areas would be evaluated under a new adaptive management framework prior to determining management action.	**Proposed Management** No additional data would be needed to make final management action determinations.
Outcome of continuing current management framework shown above or implementing proposed new adaptive management framework	**Current Management Outcome** Of the 91 lakes in the study area, **62** would continue to have fish **29** would remain fishless.	**Possible Future Outcome** Of the 91 lakes in the study area, **29** lakes would have fish **49** lakes would be fishless **13** lakes would be evaluated before determining management action.	**Possible Future Outcome** Of the 91 lakes in the study area, **9** lakes would have fish **80** lakes would be fishless **2** lakes would be evaluated before determining management action.	**Possible Future Outcome** Of the 91 lakes in the study area, **91** lakes would either remain fishless or become fishless over time
Implementation	The NPS would seek clarification from Congress as to whether stocking should be an accepted practice in the North Cascades Complex.	Same as alternative A.	Same as alternative A.	No congressional action would be necessary.

TABLE 14: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Elements	Alternative A (No Action) Existing Management Framework of 91 Lakes (62 Lakes Have Fish)	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless
Current and Proposed Management (continued)				
Consistency with *NPS Management Policies* (NPS 2001a)	This alternative is not consistent with existing *NPS Management Policies* regarding fish stocking and the introduction of exotic species.	This alternative is not consistent with existing *NPS Management Policies* regarding fish stocking and the introduction of exotic species.	This alternative is consistent with existing *NPS Management Policies* regarding fish stocking and the introduction of exotic species into national recreation areas lakes.	This alternative is consistent with existing *NPS Management Policies* regarding fish stocking and the introduction of exotic species.
Fish species (and strains) stocked (under alternative A) or fish species (and strains) proposed to be stocked under alternatives B and C	• Golden Trout • Coastal Cutthroat Trout (Lake Whatcom Strain) • Rainbow Trout (Mt. Whitney Strain) • Rainbow Trout (Ross Lake Strain) • Westslope cutthroat trout (twin Lakes Strain	• Rainbow Trout (Mt. Whitney Strain) • Rainbow Trout (Ross Lake Strain) • Golden Trout	• Rainbow Trout (Mt. Whitney Strain)	No lakes would be stocked.
Current and proposed reproducing fish species (and strains) to be maintained under alternatives A, B, and C	• Rainbow Trout (Packwood Lane Strain) • Westslope Cutthroat Trout (Twin Lakes Strain) • Brook Trout • Coastal cutthroat Trout (Lake Whatcom Strain) • Yellowstone Cutthroat Trout	• Rainbow Trout (Strain unknown) • Westslope Cutthroat Trout (Strain unknown) • Golden Trout • Westslope Cutthroat Trout (Twin Lakes Strain) • Yellowstone Cutthroat Trout	• Westslope cutthroat trout (Twin Lakes Strain) • Westslope cutthroat (Unknown Strain)	Two lakes potentially would contain reproducing fish populations: • Westslope cutthroat trout (Twin Lakes Strain) • Westslope cutthroat (Unknown Strain)

TABLE 14: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Elements	Alternative A (No Action) Existing Management Framework of 91 Lakes (62 Lakes Have Fish)	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless
Current and Proposed Management (continued)				
Fish hatchery locations	• Arlington Hatchery, Washington • Eells Springs Hatchery, Washington • Marblemount Hatchery, Washington • WDFW Bellingham Hatchery, Washington • WDFW Chelan Hatchery, Washington	Same as alternative A.	Same as alternative A.	No lakes would be stocked.
Stocking density	Stocking density varies from year to year; see table 6 for stocking density of the most recent stocking efforts.	Same as alternative A.	Same as alternative A.	No lakes would be stocked.
Specific times of year for stocking	Stocking occurs during the ice-free period, which varies from year to year, but on average is between mid-July to mid-September; stocking can occur as early as mid-May or as late as mid-October depending on weather conditions.	Same as alternative A.	Same as alternative A.	No lakes would be stocked.
Stocking methods (and performed by whom)	Fixed-wing aircraft (by WDFW). Backpack (by WDFW and volunteers from Trail Blazers, Inc.).	Same as alternative A.	Same as alternative A.	No lakes would be stocked.

TABLE 14: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Elements	Alternative A (No Action) Existing Management Framework of 91 Lakes (62 Lakes Have Fish)	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless
Lake Treatments to Manage the Fishery				
Mechanical methods (using gill and fyke nets/electrofishing/ trapping, exclusion of habitat)	No mechanical methods are used to remove fish.	8 lakes	10 lakes	11 lakes
Chemical methods (using chemicals that kill fish)	No chemical methods are used to remove fish.	19 lakes	25 lakes	25 lakes
Natural methods (discontinue stocking)	No natural methods are used to remove fish.	12 lakes	21 lakes	26 lakes
Monitoring Program				
	Trail Blazers and Hi-Lakers perform periodic surveys. From 1968 to 2001, 133 anglers filed 90 reports for 31 lakes. Reports yield estimates of fish abundance, growth, and species composition, as well as angler effort, success, and usage. Continue monitoring macroinvertebrates and expand to include stocked lakes. WDFW would continue to collect data from Trail Blazers and Hi-Lakers. Continue monitoring visitor use. Data related to fishing would be useful in determining adaptive management, especially fish stocking.	Same as alternative A, with additional monitoring of • species assemblages in lakes with fish • visitor use relating to fishing • species assemblages and collecting of physical data needed before treating lakes for fish removal • recovery of species assemblages after treating lakes for fish removal	Same as alternative B.	Same as alternative B.

TABLE 14: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Elements	Alternative A (No Action) Existing Management Framework of 91 Lakes (62 Lakes Have Fish)	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless
Mitigation				
	No mitigation occurs under alternative A.	Nonreproducing fish would be stocked to prevent establishment of reproducing, self-sustaining populations of fish. Reproduction would be limited by inducing genetic sterility or selecting hatchery strains that cannot reproduce due to spawning habitat limitations and/or timing of spawning limitations (e.g., Mount Whitney rainbow trout). For lakes with no spawning habitat, fish native to the surrounding watershed (e.g., Ross Lake rainbow trout in the Skagit River basin) would be stocked. Over the long term, the WDFW would also work toward creating hybrid, sterile hatchery strains to further minimize the risks of in-lake reproduction and downstream dispersal and hybridization with native fish. Where applicable, stocking would be rotated to allow resting periods so native species could recover. Stocking methods could be limited to horse or backpack to limit impacts on other park visitors. Protocols for fish removal would be strictly enforced to avoid impacts on other species and on worker and visitor safety (see appendix I).	Same as alternative B.	Fish removal protocols would be strictly enforced to avoid impacts on other species and on worker and visitor safety (see appendix I).
Cost of Implementation				
	Approximately $270,000 over the next 15 years.	Approximately $2.14 million over the next 15 years.	Approximately $2.84 million over the next 15 years.	Approximately $3 million over the next 15 years.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Aquatic Organisms				
	Aquatic organisms (including plankton, macroinvertebrates, and amphibians) would continue to experience long-term negligible to minor adverse impacts from fish predation and competition in lakes stocked with low densities of nonreproducing fish. In lakes with high densities of reproducing fish, certain plankton and macroinvertebrates would continue to experience long-term moderate to major adverse impacts from intensive predation and competition. Long-term minor to moderate adverse impacts on amphibians would continue in lakes with reproducing populations of fish, limited refugia, relatively high nutrient (for example, high total Kjeldahl nitrogen) availability, and limited lake connectivity to other water bodies with suitable amphibian habitat. Long-term moderate to major adverse impacts from hybridization between native and nonnative fish would continue to persist. Short- and long-term adverse cumulative impacts on aquatic organisms would vary widely depending upon trends in aquatic ecosystem stressors such as air pollution, development in surrounding watersheds, and climate change. Overall, the cumulative impacts associated with other actions in the area, added to the impacts predicted under alternative A, would result in short- and long-term minor to	Impacts on aquatic organisms in lakes stocked with low densities of nonreproducing fish would be the same as alternative A, except these impacts would decline further in the future as stocking is curtailed or eliminated in lakes based upon adaptive management decisions pertaining to stocking. Removal of reproducing populations of fish from select lakes would eventually result in long-term beneficial effects on aquatic organisms in those lakes; however, removal of reproducing fish populations would take many years. Until fish are removed, minor to major impacts on aquatic organisms would persist as described in alternative A. Mechanical methods of fish removal (netting, trapping, spawning habitat exclusion) would have short-term negligible to minor adverse impacts on aquatic organisms. Chemical methods of fish removal (application of the piscicide antimycin) would have short-term negligible to moderate adverse impacts on certain aquatic organisms. Compared to alternative A, the risk of hybridization would decline over the long term as reproducing populations of fish are removed, and fewer nonnative fish dispersed downstream from lakes. The risk of hybridization, however, would not be entirely eliminated primarily because reproducing populations of nonnative fish are now present in many	Impacts on aquatic organisms would be similar to alternative B except impacts would only occur in national recreation area lakes that would continue to be stocked with low densities of nonreproducing fish. Removal of reproducing populations of fish from lakes in the national park portion of the North Cascades Complex would have the same effects on aquatic organisms as under alternative B. Impacts of mechanical and chemical methods of fish removal would be the same as under alternative B. Impacts on native fish from hybridization between native and nonnative fish would be the same as under alternative B. Compared to alternative A, there would be a long-term beneficial cumulative impact on populations of native aquatic organisms because a minimum of 51 lakes (all lakes in the national park unit and select national recreation area lakes) would eventually become fishless. Short- and long-term adverse cumulative impacts on aquatic organisms from threats other than nonnative fish would be similar to alternative B. Impairment of aquatic organisms across the study area would not occur under alternative C.	Compared to alternative A, long-term beneficial impacts would occur to aquatic organisms as lakes are returned to a fishless condition. Once stocked fish were gone, native aquatic communities would eventually revert to predisturbance (that is, prestocking) conditions, and this would result in long-term beneficial impacts on native aquatic organisms. Removal of reproducing populations of fish from all study area lakes in the North Cascades Complex would have the same effects on aquatic organisms as under alternative B. Impacts of mechanical and chemical methods of fish removal would be the same as under alternative B. Impacts on native fish from hybridization between native and nonnative fish would be the same as under alternative B. Compared to alternative A, there would be a long-term beneficial cumulative impact on populations of native aquatic organisms because all study area lakes in the North Cascades Complex would eventually become fishless. Short- and long-term adverse cumulative impacts on aquatic organisms from threats other than nonnative fish would be similar to alternative B. Impairment of aquatic organisms across the study area would not occur under alternative D.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Aquatic Organisms (continued)				
	potentially major adverse impacts on plankton, macroinvertebrates, and amphibians, and/or certain species of native fish in individual lakes in the study area but with overall minor to moderate adverse impacts for the region. Impairment of aquatic organisms across the study area would not occur under alternative A.	drainages throughout the North Cascades Complex. Impacts over the long term would be minor to moderate and adverse. Compared to alternative A, there would be a long-term beneficial cumulative impact on native aquatic organisms because a minimum of 20 lakes would eventually become fishless. Short- and long-term adverse cumulative impacts on aquatic organisms from threats other than nonnative fish would be similar to alternative A. Impairment of aquatic organisms across the study area would not occur under alternative B.		
Wildlife				
	The historic and current stocking of fish created suitable conditions for piscivorous wildlife, such as fish-eating ducks, while potentially restricting populations of other species, such as amphibians, that are prey for several wildlife species. Impacts from activities associated with periodic fixed-wing aircraft stocking (noise disturbance) and backpack stocking (human presence and habitat trampling) under alternative A would be short term, negligible to minor, and adverse on wildlife at or near the lakes. Animals that roost or dwell further away from lakes, such an ungulates, bats, rodents, and many forest-dwelling birds, would incur short-term, negligible, adverse impacts or no impacts from stocking activities.	Removal of fish would result in the loss of a food source for fish-eating species, requiring them to disperse to other areas in search of resources; because of this, piscivorous wildlife would incur long-term negligible to minor adverse impacts when lakes are returned to fishless conditions. Impacts from stocking activities would be similar to alternative B, except the number of lakes stocked would decrease under alternative B. Mechanical and chemical treatment methods used to remove fish under alternative B would result in short-term negligible to minor adverse impacts on wildlife, with short-term disturbance to birds and mammals that inhabit the lake and shoreline from the noise of human	Impacts on fish-eating species from removal of fish would be similar to alternative B. Impacts from stocking activities would be similar to alternative B, except the number of lakes stocked would substantially decrease under alternative C. Impacts from mechanical and chemical treatment methods would be the same as alternative B. Cumulative impacts would be similar to alternative A. Impairment of wildlife species across the study area would not occur under alternative C.	Alternative D would have long-term, minor to moderate adverse impacts on fish-eating wildlife in lakes that would become fishless. Removal of fish would result in the loss of habitat for fish-eating species, requiring them to relocate to other areas (potentially outside the North Cascades Complex) in search of resources, which would result in local population decreases for those species, returning the area to pre-stocked conditions. Under alternative D, stocking activities would be eliminated, a benefit to wildlife that would be disturbed by the noise and human disturbance associated with stocking activities.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Wildlife (continued)				
	None of the 91 lakes are currently treated for fish removal under alternative A; therefore, wildlife in or near the lakes would not incur impacts from lake treatments. The impacts associated with other projects and fishery management actions in the area plus impacts from potential airborne pollution, added to the impacts predicted under alternative A, would result in long-term minor adverse cumulative impacts on wildlife populations and communities in the region. Impairment of wildlife species across the study area would not occur under alternative A.	presence and helicopters used to transport equipment for mechanical treatment. Cumulative impacts would be similar to alternative A. Impairment of wildlife species across the study area would not occur under alternative B.		Impacts of treatment methods would be the same as alternative B. Cumulative impacts would be the same as under alternative A. Impairment of wildlife species across the study area would not occur under alternative D.
Special Status Wildlife Species				
	Based on available information, fixed-wing aircraft noise and human disturbance associated with periodic fish-stocking activities under alternative A would have a range of short-term negligible to minor effects on special status wildlife species. Fish removal does not occur under alternative A, so there would be no impacts on special status wildlife species from lake treatments to remove fish.	Fish-stocking activities under alternative B would have a range of short-term negligible to minor effects on some special status wildlife species but would be reduced from the effects that would occur under alternative A. The use of the chemical, antimycin, to remove fish is not known to have adverse impacts on amphibians. There would be long-term beneficial effects on some aquatic species because most high-density reproducing populations of fish would be replaced with low-density nonreproducing stocked fish.	Fish-stocking activities under alternative C would have a range of short-term negligible to minor effects on some special status wildlife species but would be reduced from the effects that would occur under alternatives A and B. Short-term impacts related to lake treatments to remove fish would be minor, mostly due to noise from helicopters transporting lake treatment equipment and human disturbance during treatment activities. Impacts from the use of antimycin to remove fish would be the same as under alternative B.	All fish stocking would be discontinued under alternative D. Short-term impacts related to lake treatments to remove fish would be minor, mostly due to noise from helicopters transporting lake treatment equipment and human disturbance during treatment activities. Impacts from the use of antimycin to remove fish would be the same as under alternative B.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Special Status Wildlife Species (continued)				
	Based on the available information, alternative A would have ***no adverse effects on federally listed species*** from fish stocking. Regarding ***federally listed species:*** **21 species may be affected but are not likely to be adversely affected** (American peregrine falcon, California wolverine, Canada lynx, gray wolf, grizzly bear, marbled murrelet, Northern goshawk, Northern spotted owl, Pacific fisher, Yuma myotis, long-eared bat, bald eagle, harlequin duck, little willow flycatcher, olive-sided flycatcher, Cascades frog, Columbia spotted frog, northern red-legged frog, bull trout, Chinook salmon, Coho salmon). **2 species would incur no effect** (tailed frog and Western toad). **1 species may be affected and is likely to be adversely affected** (westslope cutthroat trout)—effects would be limited to one drainage downstream from McAlester Lake as a result of documented hybridization and colonization. Regarding ***state-listed species that are not federally listed***, 6 species would incur short-term negligible to minor adverse impacts (solely from noise related to stocking activities), and the common loon would incur short-term negligible adverse impacts. Continuation of stocking would provide beneficial effects by	Based on the available information, alternative B would have ***no adverse effects on federally listed species*** from fish stocking or lake treatments to remove fish. Regarding ***federally listed species:*** **23 species may be affected, but are not likely to be adversely affected:** Same as A, with the addition of the Western toad, and western cutthroat trout. **1 species would incur no effect** (tailed frog). Regarding ***state-listed species that are not federally listed***, 6 species would incur short-term negligible to minor adverse impacts from noise related to stocking and lake treatment activities, and the common loon would incur long-term minor to moderate adverse impacts due to the removal of its primary food source from Hozomeen Lake. Cumulative impacts would be the same as under alternative A. Impairment of special status wildlife species across the study area would not occur under alternative B.	Based on the available information, alternative C would have ***no adverse effects on federally listed species*** from fish stocking or lake treatments to remove fish. Regarding ***federally listed species:*** **23 species may be affected, but are not likely to be adversely affected:** Same as alternative B. **1 species would incur no effect** (tailed frog). Regarding ***state-listed species that are not federally listed***, 6 species would incur short-term negligible to minor adverse impacts from noise related to stocking and lake treatment activities, and the common loon would incur long-term minor to moderate adverse impacts due to the removal of its primary food source from Hozomeen Lake. Cumulative impacts would be the same as under alternative A. Impairment of special status wildlife species across the study area would not occur under alternative C.	Based on the available information, alternative D would have ***no adverse effects on federally listed species*** from lake treatments to remove fish. Regarding ***federally listed species:*** **22 species may be affected, but are not likely to be adversely affected** (American peregrine falcon, California wolverine, Canada lynx, gray wolf, grizzly bear, little willow flycatcher, marbled murrelet, Northern goshawk, Northern spotted owl, olive-sided flycatcher, Pacific fisher, Yuma myotis, long-eared bat, bald eagle, harlequin duck, Cascades frog, Columbia spotted frog, northern red-legged frog, Western toad, bull trout, Chinook salmon, Coho salmon, and westslope cutthroat trout). **2 species would incur no effect** (Cascades frog and tailed frog). Regarding ***state-listed species that are not federally listed***, 6 species would incur negligible to minor adverse impacts from noise related to fish removal activities, and the common loon would incur minor to moderate adverse impacts due to the removal of its primary food source from Hozomeen Lake. Cumulative impacts would be the same as under alternative A. Impairment of special status wildlife species across the study area would not occur under alternative D.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Special Status Wildlife Species (continued)				
	supporting an adequate food base for nesting loons near Hozomeen Lake and other stocked lakes. Cumulative impacts on each special status species from projects or actions occurring throughout the region would be adverse; however, alternative A would contribute only a small increment to overall cumulative impacts. Impairment of special status wildlife species across the study area would not occur under alternative A.			
Special Status Plant Species				
	Fish-stocking activities at lakes with shoreline meadow or shrub vegetation would have short-term negligible to minor adverse impacts on any special status plants in the shoreline areas of lakes in cross-country zones or near camps with low visitor use. Stocking activities at lakes in zones or near camps with medium to high visitation would result in short-term negligible to major adverse impacts on any special status plants. No lakes are treated for fish removal under alternative A. Trampling by stock (horses, mules, llamas) and visitors (anglers and other visitors) would likely result in minor to moderate cumulative impacts at some lakes and moderate to major at others, depending on the intensity of use and location of sensitive plants.	Fewer lakes would be stocked under alternative B. Trampling during stocking activities may result in negligible to minor adverse impacts at lakes in cross-country zones or near camps that have low visitor use and negligible to moderate adverse impacts on any special status plants that may be present in the shoreline of lakes that are in zones or near camps that receive medium to high use. There would long-term beneficial effects on special status plant species at lakes where stocking would not occur. Select lakes would be treated for fish removal under alternative B. Trampling during mechanical and chemical lake treatment activities may result in short-term negligible to minor adverse impacts on any special status plants that may be present in the shoreline of lakes that are in cross-country zones or near camps	Impacts from stocking activities would be similar to alternative B, except that with considerably fewer lakes stocked, impacts would be reduced to negligible to minor and adverse over the long term. Impacts from mechanical and chemical lake treatment activities to remove fish would be similar to alternative B, although a higher number of lakes would be treated for fish removal under alternative C than under alternative B. Cumulative impacts would be similar to alternative B, except as fish stocking is eliminated in the park, impacts would be reduced to negligible over the long term. Impairment of special status plant species across the study area would not occur under alternative C.	Fish stocking would not occur under alternative D, which would result in long-term beneficial effects on special status plant species. Mechanical and chemical lake treatment activities to remove fish would result in impacts similar to alternative B. Cumulative impacts would be the same as under alternative C. Impairment of special status plant species across the study area would not occur under alternative D.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Special Status Plant Species (continued)				
	Impairment of special status plant species across the study area would not occur under alternative A.	that receive medium to high visitor use, and negligible to minor adverse impacts at lakes in zones or near camps that have low visitor use. Cumulative impacts would be similar to alternative A but would be reduced as fish are removed from lakes. Impairment of special status plant species across the study area would not occur under alternative B.		
Vegetation				
	Fifty-nine of the 62 lakes in the study area where fishing would continue have meadow and/or shrub vegetation. Of these, about 75% have low to medium visitation, and vegetation would experience only negligible impacts. The remaining 25% that have high visitation would continue to experience long-term minor to moderate adverse impacts from trampling. Forest shoreline vegetation would generally not be affected more than a negligible or minor level from visitor use, including angling. Cumulative impacts would be negligible to moderate and adverse over the long term. Impairment of vegetation across the study area would not occur under alternative A.	Twenty-nine of the 35 lakes in the study area where fishing would continue have meadow vegetation that is sensitive to trampling. Eleven of the 29 lakes are within cross-country zones or near camps that would continue to experience low visitor use, with resulting negligible to minor adverse impacts. Eighteen of the 29 lakes are within cross-country zones or near camps that would continue to experience medium to high visitor use, and vegetation would experience negligible to moderate impacts. In addition to the 29 lakes that are currently fishless in alternative A, alternative B would return 20 lakes to a fishless condition with possible negligible to moderate benefits to shoreline meadow vegetation over time. Temporary negligible to moderate adverse impacts on shoreline vegetation from trampling related to chemical or mechanical lake treatments would occur, and continued fishing as a means of natural removal would have	Alternative C would provide substantial long-term benefits to meadow and sensitive forest vegetation from the return of 51 additional lakes to fishless conditions compared to alternative A. The majority of these lakes have meadow vegetation, and 29 of the 51 lakes are located in cross-country zones or near camps that receive a medium to high level of use. To the extent this use is attributable to fishing and fishing-related stock use, benefits to vegetation would occur at these lakes. Of the 9 lakes where fishing would continue, 6 are in cross-country zones or near camps that experience light use now, which would most likely continue to have negligible adverse impacts on vegetation. Three lakes are in cross-country zones or near camps that would continue to experience medium or high use, with resulting negligible to moderate adverse impacts on meadow vegetation. One lake may continue to experience minor or even moderate impacts on	Under alternative D, 62 additional lakes would be returned to fishless conditions compared to alternative A. Vegetation at these lakes would experience overall beneficial impacts. The degree of benefit would range from negligible to moderate and would depend on the level of visitor use, access, sensitivity of the vegetation, and other factors. The majority of these lakes have meadow vegetation. If high visitor use, stock use, and trail use are related to fishing, a decline in fishing opportunity would offer substantial benefits to this more sensitive vegetative community. Temporary negligible or minor adverse impacts on shoreline vegetation from trampling related to chemical or mechanical lake treatment would occur, and continued fishing as a means of natural removal would have short-term negligible to moderate adverse impacts. Adverse cumulative impacts would be negligible to moderate and long term.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Vegetation (continued)				
		short-term negligible to moderate adverse impacts. Adverse cumulative impacts would be negligible to moderate and long term. Impairment of vegetation across the study area would not occur under alternative B.	shoreline forest vegetation. Temporary negligible or minor adverse impacts on shoreline vegetation from trampling related to chemical or mechanical lake treatment would occur, and continued fishing as a means of natural removal would have short-term negligible to moderate adverse impacts. Adverse cumulative impacts would be negligible to moderate and long term. Impairment of vegetation across the study area would not occur under alternative C.	Impairment of vegetation across the study area would not occur under alternative D.
Cultural Resources				
	Alternative A would not change the number of lakes for fishing or the number of anglers using them over the long term. Potential adverse impacts of unknown intensity on archeological resources would be mitigated to negligible to minor. Mitigation would also help keep impacts on historic structures from exceeding minor levels. Potential impacts on cultural landscapes would be mitigated to no greater than minor. No impacts on ethnographic resources are anticipated. For the purpose of compliance with section 106 of the *National Historic Preservation Act*, there would be no adverse effect on cultural resources. Adverse cumulative impacts would range from negligible to minor over the long term.	Possible impacts on archeological resources that would result from preparation of mechanical fish removal equipment and helicopter use (and associated landing pads adjacent to lakes) to transport the equipment would be mitigated to negligible to minor through survey and monitoring prior to use. Possible adverse impacts on historic structures are of unknown magnitude but would not likely exceed negligible to minor. Potential impacts on identified cultural landscapes would be mitigated to no greater than minor. The temporary water-quality degradation from chemicals used to remove fish would potentially result in adverse impacts of unknown intensity on ethnographic resources used by Native Americans for traditional purposes. Such impacts would be	The impact of reduced sport-fishing opportunities would result in negligible impacts on archeological resources in general, with beneficial effects as a result of the return of one lake identified as sensitive to a fishless state. Adverse impacts on historic structures are likely to be negligible; the elimination of fishing at one particularly sensitive lake would result in a benefit to historic structures. Cultural landscapes in the study area may incur no greater than minor adverse impacts; in one case, a benefit to the resources would be realized. Impacts on ethnographic resources would likely be mitigated to negligible. For the purpose of compliance with section 106 of the *National Historic Preservation Act*, there would be no adverse effect on cultural resources.	Under alternative D, the long-term effects of elimination of fishing at all of the mountain lakes in the study area would result in reduced human fishing activity, a benefit to archeological resources in the North Cascades Complex. More specifically, those lake and trail areas identified as sensitive regarding cultural resources would incur benefits by way of reduced risk of disturbance. Adverse impacts on cultural landscapes would likely be negligible; minor benefits may be realized at one designated cultural landscape where fishing would be eliminated. For the purpose of compliance with section 106 of the *National Historic Preservation Act*, there would be no adverse effect on cultural resources.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Cultural Resources (continued)				
	Impairment of cultural resources across the study area would not occur under alternative A.	mitigated to negligible through an agreement with the NPS, affected Tribes, and the State Historic Preservation Office regarding the timing of management activities and locations of specific areas that should be avoided. For the purpose of compliance with section 106 of the *National Historic Preservation Act*, there would be no adverse effect on cultural resources. Adverse cumulative impacts would range from negligible to minor over the long term. Impairment of cultural resources across the study area would not occur under alternative B.	There would be beneficial cumulative impacts for cultural resources from reduced human activity at a number of mountain lakes. Impairment of cultural resources across the study area would not occur under alternative C.	Cumulative impacts would be beneficial. Impairment of cultural resources across the study area would not occur under alternative D.
Visitor Use and Experience				
Recreational Use	Impacts on non-anglers under alternative A would primarily be related to noise and disruption from fixed-wing aircraft stocking activities. Such adverse impacts would be negligible and temporary but would continue over the long term as stocking activities continue. Anglers would experience long-term beneficial impacts because they would continue to enjoy fishing activities unchanged from the past. Cumulative impacts would result from the partial loss of the Stehekin Valley Road due to flooding that occurred in the fall of 2003. The fate of the road is currently uncertain. If the road is not repaired, then access to backcountry portions of the Stehekin	Adverse impacts on non-anglers under alternative B would primarily be related to lake treatment methods. These impacts would be negligible to minor adverse over the long term. Removal of fish from some lakes would reduce visitor use and have some long-term beneficial impacts on non-anglers seeking greater solitude in the backcountry. Impacts on most anglers overall would be minor to moderate, adverse, and long term from management actions under alternative B compared to alternative A. Major adverse impacts would occur to some anglers who believe fishing in North Cascade Complex lakes is a truly unique experience that cannot be duplicated elsewhere.	Same as alternative B. Major adverse impacts would occur to some anglers who believe fishing in North Cascade Complex lakes is a truly unique experience that cannot be duplicated elsewhere.	Same as alternative B. Major adverse impacts would occur to some anglers who believe fishing in North Cascade Complex lakes is a truly unique experience that cannot be duplicated elsewhere. Overall, cumulative impacts would be moderate, adverse, and long term. The cumulative impact of reduced access in the Stehekin Valley due to flood damage would be minor adverse or beneficial to backcountry users.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Visitor Use and Experience (continued)				
Recreational Use (continued)	Valley may be more difficult, and this would reduce the amount of backcountry visitation. Some visitors might enjoy the increased solitude and wilderness setting, while others might lament the reduced access to backcountry areas in the Stehekin Valley, including fishable lakes. Therefore, adverse cumulative impacts on visitor use would be minor to moderate over the long term.	Cumulative impacts related to angler displacement to overused areas outside the North Cascades Complex would overall be minor to moderate, adverse, and long term. The cumulative impact of reduced access in the Stehekin Valley due to flood damage would be minor adverse or beneficial to backcountry users.		
Social Values	Continuation of existing management actions under alternative A would have a beneficial effect on the social values of anglers and angler groups because stocking and sport fishing would not change. Impacts on social values of conservationists and conservation groups would be long term, moderate to major, and adverse. Continuation of management actions as described in alternative A would not alter angler use; therefore, cumulative impacts on social values of anglers would be long term and beneficial. Continuation of management actions as described in alternative A would have a moderate to major adverse cumulative impact on conservationists and conservation groups.	Alternative B would have a minor adverse impact on the social values of anglers and angler groups over the long term because some level of stocking and sport fishing would continue over the long term. Impacts on social values of conservationists and conservation groups would be beneficial for some who would support the new management framework but moderate to major adverse and long term for those who oppose any stocking of lakes over the long term. Alternative B would have a moderate to major adverse cumulative impact on conservationists and conservation groups, but some may support the adaptive management approach, which may reduce impacts to some degree. Cumulative impacts on anglers and angling groups would be moderate to major, adverse, and long term, but some may support the adaptive management approach, which may reduce impacts to some degree. Cumulative impacts related to flood damage to upper Stehekin Valley Road would be minor to moderate, adverse, and long term.	Alternative C would have a moderate to major adverse impact on the social values of anglers and angler groups over the long term because sport fishing would eventually be eliminated in the national park, and many anglers and angler groups believe that fishing in the park is a unique opportunity that cannot be duplicated elsewhere. Impacts on social values of conservationists and conservation groups would be the same as under alternative B. Cumulative impacts would be the same as under alternative B.	Alternative D would have a moderate to major adverse impact on the social values of anglers and angler groups over the long term, especially for those who use and value the park for this experience. Anglers may choose to pursue sport fishing outside the North Cascades Complex. Overall, impacts on social values of conservationists and conservation groups would be beneficial. Cumulative impacts would be the same as under alternative B.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Visitor Use and Experience (continued)				
Wilderness Values	Backpack stocking would have a short- and long-term negligible direct impact on visitor solitude. Given the brief and infrequent nature of fixed-wing aircraft stocking, there would be a short- and long-term minor adverse impact on opportunities for solitude. Sport-fishing opportunities would remain at current levels. This would result in long-term negligible impacts on opportunities for solitude for those areas that receive relatively little use, and would result in long-term minor adverse impacts on opportunities for solitude for those areas that receive high use. Impacts on other visitors' opportunities for primitive recreation in high-use areas over the summer would be long-term minor to moderate and adverse. Those with an anthropocentric perspective (valuing human use and enjoyment of wilderness) would experience negligible long-term impacts under alternative A. Those with strong biocentric views (support protection of natural processes in wilderness areas) of wilderness would experience major, long-term adverse impacts by the continued fishery management practices under alternative A. Impacts on wilderness users who are unaware that fish are present in the lakes would be negligible over the long term. Cumulative impacts on fishing opportunities in mountain lakes from	Backpack and fixed-wing aircraft stocking would result in impacts similar to alternative A, except fewer lakes would be stocked. Fishery management actions would reduce sport-fishing opportunities compared to alternative A. This would result in a long-term minor beneficial impact on opportunities for solitude in some areas. However, some lakes in certain high-use areas would remain fishable, resulting in minor adverse impacts on opportunities for solitude over the long term. The impacts on solitude from fish removal activities would be minor to moderate and adverse over the long term. Anglers who choose to fish elsewhere due to the reduced fishing opportunities would experience long-term minor adverse impacts. Anglers who believe the fishing experience cannot be duplicated elsewhere would experience long-term major adverse impacts. Impacts on other visitors' opportunities for primitive recreation in high-use areas over the summer would be minor to moderate adverse over the long term. Those with anthropocentric perspective would experience negligible long-term impacts under alternative B. Those with an anthropocentric perspective may view the application of a science-based adaptive management plan as a negligible impact, and some may view this as beneficial. Those with strong biocentric views of wilderness would experience long-term major	Backpack and fixed-wing aircraft stocking would result in impacts similar to alternative A, except to a lesser degree because fewer lakes would be stocked, and these lake would only be in the national recreation areas. Fishery management actions would reduce sport-fishing opportunities compared to alternatives A and B. Sport-fishing opportunities would be eliminated in national park lakes but would continue to exist in select national recreation area lakes. This would result in a long-term moderate beneficial impact on opportunities for solitude in some areas. However, some lakes in certain high-use areas would remain fishable, resulting in long-term minor adverse impacts on opportunities for solitude. Impacts on solitude from fish removal activities would be long term minor to moderate and adverse. Anglers who choose to fish elsewhere due to the reduced fishing opportunities would experience long-term minor adverse impacts. Anglers who believe the fishing experience cannot be duplicated elsewhere would experience major adverse long-term impacts. Impacts on visitor opportunities for primitive recreation in high-use areas over the summer would be long term minor to moderate and adverse. Those with an anthropocentric perspective would experience long-term moderate adverse impacts under alternative C due to the loss of	Sport-fishing opportunities would be vastly reduced compared to alternative A because all stocking in the North Cascades Complex would cease, and fish would be removed from all lakes, where feasible. This would result in long-term moderate to major beneficial impacts on opportunities for solitude in areas where fishing opportunities are eliminated. However, fishing opportunities would continue to exist in the nine deep lakes where complete fish removal may not be feasible, resulting in long-term minor adverse impacts on opportunities for solitude. Impacts on solitude from fish removal activities would be minor to moderate and adverse over the long term. Anglers who choose to fish elsewhere due to reduced fishing opportunities would experience long-term minor adverse impacts. Anglers who believe the fishing experience cannot be duplicated elsewhere would experience long-term major adverse impacts. The cessation of anglers using wilderness would result in long-term beneficial impacts on other visitors. Those with an anthropocentric perspective would experience long-term major adverse impacts. Those with an anthropocentric perspective may view the application of a science-based adaptive management plan to remove fish as a negligible impact, and some would view this as beneficial.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Visitor Use and Experience (continued)				
Wilderness Values (continued)	reduced access would likely be negligible over the short and long terms. There would be a long-term major adverse cumulative impact on those who believe that continued stocking and continued presence of reproducing fish populations under alternative A would compromise natural processes in wilderness. There would be long-term negligible cumulative impacts on those who believe that human use and enjoyment of wilderness should continue.	adverse impacts from fishery management actions under alternative B. Some with biocentric perspectives would view the application of a science-based adaptive management plan as beneficial over the long term. Impacts on wilderness users who are not aware that fish are present in the lakes would be negligible over the long term. Cumulative impacts on fishing opportunities in mountain lakes from reduced access would likely be negligible over the short and long terms. There would be a long-term major adverse cumulative impact on those who believe that the continued stocking (as proposed under alternative B) in wilderness and continued presence of reproducing populations of fish would compromise natural processes in wilderness. There would be long-term negligible cumulative impacts on those who believe that human use and enjoyment of wilderness should continue. Depending on one's views regarding the application of science-based adaptive management principles in wilderness areas, cumulative impacts would be long term beneficial or adverse. Fishery management actions, including fish removal, would have a minor adverse cumulative impact on solitude over the long term.	fishable lakes in the national park; however, fishing opportunities would still remain in wilderness areas in select national recreation area lakes. Those with an anthropocentric perspective may view the application of a science-based adaptive management plan as a negligible impact, and some may view this as beneficial over the long term. Those with strong biocentric views of wilderness would experience long-term major adverse impacts from the fishery management actions under alternative C. Some with biocentric perspectives may view the application of a science-based adaptive management plan as beneficial over the long term. Impacts to wilderness users who are not aware that fish are present in the lakes would be negligible over the long term. Cumulative impacts on fishing opportunities in mountain lakes from reduced access would likely be negligible over the short and long terms. There would be a long-term major adverse cumulative impact on those who believe that the stocking proposed under alternative C and continued presence of reproducing populations of fish would compromise natural processes in wilderness. There would be long-term negligible cumulative impacts on those who believe that human use and	Those with strong biocentric views of wilderness would experience major long-term beneficial impacts because all fish would be removed (where feasible) under alternative D. Some with a biocentric perspective may view the application of a science-based adaptive management plan as beneficial over the long term. Impacts to those wilderness users who would not be aware that nonnative fish have been removed from the lakes would be negligible over the long term. Cumulative impacts on fishing opportunities in mountain lakes from reduced access would likely be negligible over the short and long terms. There would be major long-term beneficial cumulative impacts on those who believe that continued stocking in wilderness and continued presence of reproducing populations of fish would compromise natural processes. There would be long-term major adverse cumulative impacts on anglers who believe that human use and enjoyment of wilderness should continue. Depending on one's views regarding the application of science-based adaptive management principles to remove fish from wilderness areas, cumulative impacts either would be beneficial or adverse over the long term. Fishery management actions, including fish removal, would have minor adverse cumulative impacts on solitude over the long term. Due to the cessation of

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Visitor Use and Experience (continued)				
Wilderness Values (continued)			enjoyment of wilderness should continue. Depending on one's views regarding the application of science-based adaptive management principles in wilderness areas, cumulative impacts either would be beneficial or adverse over the long term. Fishery management actions, including fish removal, would have a long-term minor adverse cumulative impact on solitude. Due to the cessation of stocking in national park lakes, long-term moderate beneficial cumulative impacts on wilderness values would be expected.	stocking, moderate to major beneficial cumulative impacts on wilderness values would be expected over the long term. The displacement of anglers to other wilderness areas would result in negligible adverse cumulative impacts, even if all anglers decided to fish elsewhere.
Human Health				
	Alternative A would have negligible impacts on human health over the long term from the consumption of stocked fish that may have been exposed to persistent organic pollutants and methyl-mercury, and no adverse impacts on human health from any lake treatment chemicals since none would be used. Cumulative impacts on human health would be negligible adverse over the long term.	Impacts from stocking decisions and consumption of stocked fish would be the same as alternative A. Proposed chemical treatments that would be used to remove fish from 19 lakes would have long-term negligible adverse impacts on human health. Cumulative impacts on human health would be negligible to minor adverse over the long term.	Impacts from stocking decisions and consumption of stocked fish would be the same as alternative A. Impacts from the proposed chemical treatment of 25 lakes would be the same as alternative B. Cumulative impacts on human health would be the same as alternative B.	Impacts from consumption of fish from previously stocked lakes would be the same as alternative A. Impacts from the proposed chemical treatment of 25 lakes would be the same as alternative B. Cumulative impacts on human health would be the same as alternative B.

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Socioeconomic Resources				
	Alternative A would have long-term negligible impacts on the local and regional economies. Estimated revenues from mountain lake angling account for roughly $1 out of every $100,000 spent in the three-county region. The effects of continuation of the current fishery management program on some local businesses in the Stehekin area would be beneficial since some patrons may also engage in sport fishing in the mountain lakes located in Lake Chelan National Recreation Area. Expenditures associated with sport fishing in the mountain lakes in the North Cascades Complex would continue to have long term negligible cumulative impacts on the local and regional economies.	Similar to alternative A but with potential long-term major adverse impacts on a limited number of businesses in Stehekin due to reduced fishing opportunities in mountain lakes. Cumulative impacts would be similar to alternative A.	Similar to alternative B, except that anglers who no longer would have fishing opportunities in high mountain lakes in the national park may choose to fish in the national recreation areas. This would have a beneficial long-term impact on local businesses in Stehekin. However, if the number of anglers choosing to fish in the mountain lakes in the recreation areas substantially decrease, there would be a long-term major adverse impact on some businesses in Stehekin. Cumulative impacts on the local and regional economies overall would be long term and negligible, while some businesses in Stehekin may experience long-term major adverse impacts because other visitor uses are not expected to increase substantially. There would be beneficial economic impacts on Stehekin area businesses if anglers chose to fish in the Lake Chelan National Recreation Area because fishing in the mountain lakes outside of the national recreation areas would be eliminated.	Overall, the local and regional economies would experience long-term negligible to minor adverse impacts from the elimination of sport fishing in the mountain lakes in the study area. Compared to alternative A, some Stehekin businesses would experience long-term major adverse impacts under alternative D if their primary source of income is from anglers who fish in the study area lakes. Overall, cumulative impacts would be long term, negligible, and adverse.
Management and Operations				
	Alternative A would have a negligible to minor adverse impact on management and operations over the long term. Total implementation costs would be $270,000 over a 15-year period and would primarily be borne by the WDFW. Average annual costs would be approximately $18,000 per year.	Alternative B would have moderate adverse impacts on management and operations over the long term, assuming all sources of funding remain fairly constant. Total implementation costs would be approximately $2.14 million over the next 15 years. Average annual costs for implementation are projected at	Alternative C would have similar moderate adverse impacts on management and operations as alternative B over the long term. Total implementation costs would be approximately $2.84 million over the next 15 years. Average annual costs would be similar to alternative B, but	Alternative D would have moderate adverse impacts on management and operations over the long term, assuming all funding sources remain fairly constant. Total cost of implementing alternative D would be approximately $3 million over the next 15 years. Average annual costs

TABLE 15: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A (No Action) Existing Framework of 91 Lakes	Alternative B Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish) (Preferred Alternative)	Alternative C Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Management and Operations (continued)				
	Cumulative impacts would be negligible to minor and adverse over the long term.	approximately $112,100 for the first three years. As experience is gained conducting lake treatment and management, the number of lakes treated increases, raising costs to nearly $150,000 per year. Future stocking would be funded and implemented by the WDFW. However, should a long-term increase in NPS base funding for fishery management become available, implementing alternative B would have negligible to minor adverse impacts over the long term. Other sources of funding would be sought to reduce impacts on the park's operating budget. Cumulative adverse impacts on operations could arise from the need to respond to future unanticipated events such as flooding, wildfire, or other events. However, the magnitude of adverse impacts may range from negligible to major depending on the severity of individual future events, which could reduce the amount of potential funding available to implement the fishery management plan or cause the NPS to shift priorities to respond to more pressing needs.	the additional lakes targeted for fish removal would increase the total cost. Future stocking would be funded and implemented by WDFW. Similar to alternative B, if a long-term increase in NPS base funding becomes available, adverse impacts would become minor. Other sources of funding would be sought to reduce impacts on the park's operating budget. Cumulative impacts would be the same as alternative B.	for fish removal would be similar to alternative C. Although there are no average annual costs associated with fish stocking, the additional costs of protection required to prevent unsanctioned stocking of lakes would increase total implementation costs. Other sources of funding would be sought to reduce impacts on the park's operating budget. Cumulative impacts would be the same as alternative B.

TABLE 16: ANALYSES OF HOW ALTERNATIVES MEET OBJECTIVES

Objectives	Alternative A: (No Action) Existing Management Framework of 91 Lakes (62 Lakes Have Fish)	Alternative B: Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes May Have Fish (Preferred Alternative)	Alternative C: Proposed Adaptive Management of 91 Lakes under a New Framework (11 National Recreation Area Lakes May Have Fish)	Alternative D: 91 Lakes Would Be Fishless (Environmentally Preferred Alternative)
Obtain support from interested parties and groups to implement a new management plan for mountain lakes in the North Cascades Complex should the governing agencies decide a new plan is needed.	Meets objective to some degree. Some groups/parties would support a new management framework, but others may not depending on their individual views on protection of North Cascades Complex resources and values and availability of angling opportunities.	Meets objective to some degree. Some groups/parties would support a new management framework, but others may not depending on their individual views on protection of North Cascades Complex resources and values and availability of angling opportunities.	Meets objective to some degree. Some groups/ parties would support a new management framework, but others may not depending on their individual views on protection of North Cascades Complex resources and values and availability of angling opportunities.	Meets objective to some degree. Some groups/ parties would support a new management framework, but others may not depending on their individual views on protection of North Cascades Complex resources and values and availability of angling opportunities.
Advance the protection and rehabilitation of native biological integrity by maintaining native species abundance, viability, and sustainability.	Does not fully meet objective. Reproducing populations of fish would continue to exist in naturally fishless lakes, adaptive management practices would not be fully implemented, and stocking would continue to impact native biota.	Fully meets objective. Adaptive management strategies would remove populations of reproducing fish that are adversely impacting native biota in the park and recreation areas.	Fully meets objective. Adaptive management strategies would remove populations of reproducing fish that are adversely impacting native biota in the park. Adaptive management would be applied in the recreation areas to remove reproducing populations of fish and restocking lakes, as appropriate, with nonreproducing fish or fish native to the watersheds.	Fully meets objective. All lakes would be returned to their naturally fishless condition in the park and recreation areas, thereby maintaining native species abundance, viability, and sustainability throughout the mountain lakes.
Provide a spectrum of recreational opportunities, including sport fishing, while minimizing impacts on the biological integrity of natural mountain lakes.	Meets objective to some degree. A spectrum of recreational opportunities would continue, including sport fishing; however, the impacts of the current program would continue to adversely affect native biota and biological integrity of natural mountain lakes.	Meets objective to a large degree. Application of adaptive management strategies would remove reproducing fish that harm native biota, while restocking lakes with low densities of nonreproducing fish or fish native to the watersheds. Some lakes in both the park and recreation areas would remain available for angling while minimizing the impacts of stocking through adaptive management practices over the long term. Some illegal stocking in lakes returned to a fishless condition may occur.	Meets objective to some degree. Mountain lakes in the park would be returned to their naturally fishless condition over time. Some illegal stocking of fish in park lakes may occur. Lakes in the recreation areas would be treated to remove populations of reproducing fish, and some would be restocked to allow for angling opportunities.	Does not fully meet objective. All mountain lakes in the park and recreation areas would be treated to return lakes to their naturally fishless condition. Angling opportunities would be available in some lakes in that the period for restoration may span 20-30 years. Fishing in the reservoirs and streams would still be available. Some illegal stocking of fish in lakes may occur.

TABLE 16: ANALYSES OF HOW ALTERNATIVES MEET (CONTINUED)

Objectives	Alternative A (No Action): Existing Management Framework of 91 Lakes (62 Lakes Have Fish)	Alternative B: Proposed Adaptive Management of 91 Lakes under a New Framework (42 Lakes in the National Park and National Recreation Areas May Have Fish)	Alternative C: Proposed Adaptive Management of 91 Lakes under a New Framework (11 Lakes in the National Recreation Areas May Have Fish)	Alternative D: 91 Lakes Would be Fishless
Apply science and research in decision-making at multiple spatial scales that include landscape, watershed, lake cluster, and individual lakes.	Does not fully meet objective. While the current program does apply available science and good practices to some degree, it does not systematically apply adaptive management at a landscape, watershed, lake cluster, or individual lake scale.	Meets objective to a large degree. Adaptive management strategies would be applied with evolving science and knowledge as lakes are returned to their naturally fishless conditions. Lakes would be treated using mechanical, chemical, or natural methods to remove reproducing populations of fish while minimizing impacts on native biota. Lakes identified for restocking would be monitored and prescriptions adjusted depending upon how well native biota respond to treatment and stocking over the long term.	Meets objective to a large degree. Similar to alternative B, adaptive management strategies would be applied throughout the lakes; however, only those lakes in the recreation areas would be identified for restocking. Lakes would be treated by mechanical, chemical, or natural methods to remove reproducing populations of fish while minimizing impacts on native biota. Lakes in the recreation areas identified for restocking would be monitored and prescriptions adjusted depending upon how well native biota respond to treatment and stocking over the long term.	Meets objective to a large degree. Adaptive management strategies would be applied as fish are removed from all naturally fishless lakes throughout the park and recreation areas. Lakes would be treated by mechanical, chemical, or natural methods to remove reproducing populations of fish while minimizing impacts on native biota.
Provide to the public and interested parties full and open access to available information.	Does not meet objective. While information is available, it is not systematically and consistently provided to the public and interested parties.	Fully meets objective. As adaptive management strategies are applied and knowledge gained, outcomes would be made available to the public through various media. If monitoring revealed that a change in strategies would be necessary, the public and interested parties would be notified, and additional opportunity for public input would be provided.	Fully meets objective. As adaptive management strategies are applied and knowledge gained, outcomes would be made available to the public through various media. If monitoring revealed that a change in strategies would be necessary, the public and interested parties would be notified, and additional opportunity for public input would be provided.	Fully meets objective. As adaptive management strategies are applied and knowledge gained, outcomes would be made available to the public through various media. If monitoring revealed that a change in strategies would be necessary, the public and interested parties would be notified, and additional opportunity for public input would be provided.