

Table \_\_\_\_. Summary of All Restoration Alternatives

Resources	Alternative 1 Natural Recovery	Alternative 2 Protection	Alternative 3 Limited Restoration	Alternative 4 Moderate Restoration	Alternative 5 Comprehensive Restoration
<b>Birds</b>					
Black oystercatcher <sup>1</sup>	Monitoring; contingency agency management	40.0 Special designations			14.0 Accelerate recovery—upper intertidal 37.0 Habitat protection and acquisition 40.0 Special designations
Common murrel <sup>1</sup>	Monitoring; contingency agency management	4.1 Reduce disturbance at marine bird colonies	16.1 Study: Social stimuli 17.2 Reduce predator access	same as Alternative 3	4.1 Reduce disturbance at marine bird colonies 16.1 Study: Social stimuli 17.2 Reduce predator access
Harlequin duck <sup>1</sup>	Monitoring; contingency agency management	37.0 Habitat protection and acquisition	13.0 Eliminate oil from mussel beds 37.0 Habitat protection and acquisition	same as Alternative 3	8.0 Develop sport harvest guidelines 13.0 Eliminate oil from mussel beds 37.0 Habitat protection and acquisition
Marbled murrelet <sup>2</sup>	Monitoring; contingency agency management	37.0 Habitat protection and acquisition 40.0 Special designations	9.0 Minimize incidental take 37.0 Habitat protection and acquisition 40.0 Special designations	same as Alternative 3	same as Alternative 3
Pigeon guillemots <sup>1</sup>	Monitoring; contingency agency management	17.2 Reduce predator access	same as Alternative 3	same as Alternative 3	same as Alternative 3
Bald eagle <sup>2</sup>	Monitoring; contingency agency management	37.0 Habitat protection and acquisition	same as Alternative 2	same as Alternative 2	same as Alternative 2
<b>Fish</b>					
Cutthroat trout <sup>2</sup>	Monitoring; contingency agency management	19.0 Anadromous Streams Catalogue 37.0 Habitat protection and acquisition		same as Alternative 2	2.1 Intensify management 19.0 Anadromous Streams Catalog 37.0 Habitat protection and acquisition
Dolly varden <sup>2</sup>	Monitoring; contingency agency management	19.0 Anadromous Streams Catalogue 37.0 Habitat protection and acquisition		same as Alternative 2	2.1 Intensify management 19.0 Anadromous Streams Catalog 37.0 Habitat protection and acquisition

<sup>1</sup> Population Decline  
<sup>2</sup> Sublethal/Chronic

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Resources	Alternative 1 Natural Recovery	Alternative 2 Protection	Alternative 3 Limited Restoration	Alternative 4 Moderate Restoration	Alternative 5 Comprehensive Restoration
Sockeye salmon <sup>1</sup>	Monitoring; contingency agency management	37.0 Habitat protection and acquisition	2.5 Intensify management 48.2 Improve survival rates	same as Alternative 3	2.5 Intensify management 11.3 Improve access: salmon fish passes 37.0 Habitat protection and acquisition 48.2 Improve survival rates
Pacific herring <sup>2</sup>	Monitoring; contingency agency management			2.2 Intensify management	same as Alternative 4
Pink salmon <sup>2</sup>	Monitoring; contingency agency management	37.0 Habitat protection and acquisition 40.0 Special designations		2.3 Intensify management 51.0 Relocate existing hatchery runs	2.3 Intensify management 11.1 Construct salmon spawning channels 11.3 Improve access: salmon fish passes 19.0 Anadromous Steams Catalogue 37.0 Habitat protection and acquisition 40.0 Special designations 48.0 Improve survival rates of salmon eggs and juveniles 51.0 Relocate existing hatchery runs
Rockfish <sup>2</sup>	Monitoring; contingency agency management			2.4 Intensify management	same as Alternative 4
<b>Marine Mammals</b>					
Harbor seal <sup>4</sup>	Monitoring; contingency agency management	4.2 Reduce disturbance at marine mammal haulouts	same as Alternative 2	46.0 Cooperative program—fishers 47.0 Cooperative program—subsistence users	4.2 Reduce disturbance at marine mammal haulouts 46.0 Cooperative program—fishers 47.0 Cooperative program—subsistence users
Killer whale <sup>1</sup>	Monitoring; contingency agency management		45.0 Study: Changes in black cod fishery gear	same as Alternative 3	same as Alternative 3
Sea otter <sup>2</sup>	Monitoring; contingency agency management		4.2 Study: Reduce disturbance 13.0 Eliminate oil from mussel beds 47.0 Cooperative program—subsistence users	same as Alternative 3	4.2 Study: Reduce disturbance

<sup>1</sup> Population Decline

<sup>2</sup> Sublethal/Chronic

Resources	Alternative 1 Natural Recovery	Alternative 2 Protection	Alternative 3 Limited Restoration	Alternative 4 Moderate Restoration	Alternative 5 Comprehensive Restoration
<b>Terrestrial Mammals</b>					
River otter <sup>2</sup>	Monitoring; contingency agency management				8.0 Develop sport and trapping harvest guidelines
<b>Coastal Habitat</b>					
Intertidal organisms	Monitoring; contingency agency management		14.0 Accelerate recovery—upper intertidal	same as Alternative 3	same as Alternative 3
Archaeology	Monitoring; contingency agency management	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts	1.1 Site stewardship program 1.2 Site patrol and monitoring 110.0 Preserve archaeological sites and artifacts 35.0 Acquire replacements for artifacts from the spill area	same as Alternative 4
Commercial fishing	Monitoring; contingency agency management		18.0 Replace salmon harvest opportunities	11.2 Fertilize lakes to improve sockeye salmon rearing success 18.0 Replace salmon harvest opportunities	same as Alternative 4
Recreation	Monitoring; contingency agency management	37.0 Habitat protection and acquisition 40.0 Special designations	12.1 New backcountry public recreation facilities 37.0 Habitat protection and acquisition 40.0 Special designations	same as Alternative 4	12.1 New backcountry public recreation facilities 12.2 Plan and market public land for commercial rec facilities 33.1 Visitor centers 34.0 Marine environmental institute 37.0 Marine environmental institute 40.0 Special designations
Sport fishing	Monitoring; contingency agency management		18.0 Replace salmon harvest opportunities	30.0 Test subsistence foods 49.0 Access to traditional foods 50.1 Develop subsistence mariculture sites 50.2 Develop bivalve shellfish hatchery and rescue center	same as Alternative 4
Wilderness	Monitoring; contingency agency management	37.0 Habitat protection and acquisition 40.0 Special designations	same as Alternative 2	same as Alternative 2	same as Alternative 2

<sup>1</sup> Population Decline

<sup>2</sup> Sublethal/Chronic

## Summary of Restoration Alternative 1—Natural Recovery<sup>1</sup>

**Monitoring:** The objectives of this alternative are to describe the potential rate and degree of recovery for the injured resources with only normal agency management; identify the missing information that make the recovery estimates uncertain; describe the recovery of services; and to describe the monitoring and public information program that would be funded through the Trustee Council.

### Affected Natural Resources

#### A. Marine Mammals

**Killer whales—AB pod:** As long as there is no additional mortality due to human interactions, the AB pod is expected to fully recover to its pre-spill population level between 10 to 20 years from 1989. The overall whale population is not believed to be injured.

**Harbor seals:** The harbor seal population in the Gulf of Alaska and Prince William Sound has suffered a severe population decline since the 1970's. The reasons for this decline are unknown, which makes predicting a recovery rate from the effects of the oil spill impossible. The population is expected to continue to decline.

**Sea otters:** Sea otters are expected to recover 80–100% of their pre-spill population.

#### B. Terrestrial Mammals

**River otters:** River otters are expected to fully recover within 20 years. The injury to river otters is not well understood, therefore it is difficult to make recovery estimates or estimate the effectiveness of different restoration options.

#### C. Birds

**Bald eagles:** Bald eagles are expected to be fully recovered to the pre-spill population level between 4 to 6 years after the oil spill (1993–1995).

**Black oystercatchers:** Natural recovery is expected to occur within the next 30 years.

**Common murre:** The injured common murre populations are expected to return to between 80 to 100% of their pre-spill level.

**Harlequin ducks:** Are expected to recover within 80–100% (natural variation) of their pre-spill population level.

**Marbled murrelets:** The marbled murrelet population is not expected to return to pre-spill population levels.

**Pigeon Guillemots:** Pigeon guillemots are not expected to return to their pre-spill population levels.

#### D. Fish

**Cutthroat trout:** The injured cutthroat trout population is expected to fully recover to its pre-spill levels in about 13 years (9–19 year range).

**Dolly Varden trout:** The injured dolly varden population is expected to fully recover to its pre-spill levels in about 13 years (9–19 year range).

**Pacific Herring:** The complex population dynamics of Pacific herring make it impossible to predict the extent of injury and estimate the natural recovery rate until fish spawned during the oil spill, and subsequent years, return.

**Wild stock Pink salmon:** The overall injured population of wild stock pink salmon is expected to recover within 20 years of 1989.

<sup>1</sup>No action other than monitoring and normal agency management.

**Rockfish:** There are too many unknowns regarding the injury to rockfish to make predictions around natural recovery.

**Sockeye salmon—Kenai river system:** Natural recovery of the Kenai river sockeye salmon run is complicated by changes that occurred in the rearing habitat as a result of overescapement.

**Sockeye Salmon—Kodiak:** Natural recovery of the Kodiak, Red Lake system is expected to be rapid because the overescapement just occurred one year (rather than 1987–1989 for the Kenai system).

## **E. Coastal Habitat**

**Coastal Habitat—Upper Intertidal:** Natural Recovery of the upper intertidal zone will occur in stages as different species in the community respond to improved environmental conditions.

### **Affected Services**

- 1. Archaeologic Sites and Artifacts:** Sites and artifacts will not recover from oil damage and depredation. Managers of lands where these sites occur must prevent further site degradation and loss of artifacts and scientific information under current authority and management priority.
- 2. Subsistence:** Under the Natural Recovery Alternative, no action (restoration) other than normal agency management and monitoring will be conducted.
- 3. Recreation and Tourism:** Injury to recreation uses occurred throughout the oilspill area. As a result experiences and perceptions changed. Recreation users report less visible oil and a slow, but discernable increase in wildlife sightings.
- 4. Sport and Commercial Fishing:** Closure of commercial fisheries during the spill caused injury to those who relied on this resource for a livelihood.
- 5. Wilderness and Intrinsic Values:** The uplands of the oil spill area are generally perceived to be of wilderness character. The designated and undesignated Wildernesses have formally recognized this character. Oil found above the mean high tide impacted these areas and perceptibly injured the wilderness character of the land.

## Restoration Options Included In Alternative 1—Natural Recovery<sup>1</sup>

**Monitoring:** Monitoring under this alternative is designed to follow the progress of natural (unassisted) recovery of resources and services injured by the oil spill, and to determine when natural recovery has restored injured resources and service to their prespill conditions. Implicit in this design is the need to rely as much as possible on normal agency management and monitoring.

Where designs of prespill agency monitoring programs, as in the case of harbor seal, do not adequately address the impacts and recovery dynamics of harbor seals injured by the oil spill, monitoring harbor seal distribution and abundance on or near oiled segments of their range would be included in the Trustees' Natural Recovery Monitoring Program.

Resources to be monitored include but are not limited to affected floral (sea grasses and seaweeds) and faunal assemblages (marine mammals, marine birds including sea ducks, fish and shellfish) as well as impacted intertidal and subtidal substrates upon which they depend. Services arising from injured natural resources also will be monitored inclusive of, but not limited to: recreation, subsistence, commercial fishing, wilderness, and intrinsic values. Finally, archaeological resources will be monitored.

Resource/Service	Restoration Option
Black oystercatcher	Rate of recovery estimated 30 years with no action other than monitoring and normal agency management.
Common murre	Rate of recovery estimated 50–120 years.
Harbor seal	No rate of recovery—population expected to continue to decline.
Harlequin duck	Rate of recovery estimated at 10–50 years.
Bald eagle	Rate of recovery estimated 4–6 years.
Cutthroat trout	Rate of recovery estimated 13 years.
Dolly varden	Rate of recovery estimated at 13 years.
Marbled murrelet	No rate of recovery. Estimates of further declines range from an additional 20–50% loss with the population stabilizing at reduced level in 11–50 years.
Pink salmon	Rate of recovery estimated at 20 years.
Archaeology	No recovery estimated. Further loss and degradation to artifacts and scientific information must be prevented by agency monitoring.
Recreation	Rate of recovery will be hard to estimate, but there is a steady increase in use of recreational areas affected by the oil spill.
Wilderness	Rate of recovery for physical impacts will be reduced with time. The perception will be more difficult to diminish.

<sup>1</sup>No action other than monitoring and normal agency management.

## Restoration Options Included In Alternative 2—Protection<sup>1</sup>

**Monitoring:** Monitoring under this alternative will focus on the need to evaluate the effectiveness of specific protection measures used in restoring injured resources and services. For example, monitoring of injured resources and services would be conducted in conjunction with establishing special designations such as refugees, sanctuaries, parks and critical areas, purchase and protection of private lands, protection to reduce disturbance around marine bird colonies and marine mammal haulouts, and protection of archaeological sites to deter further degradation of sites and artifacts.

This alternative also includes the provision to determine when natural recovery will restore injured resources and services to their pre-spill conditions. It assumes that normal agency management and monitoring will not be duplicated.

**Restoration Options:** Among the many restoration ideas suggested by scientist agencies, and the public, only eight meet the criteria for this alternative. There is at least one effective restoration action for each injured resource or service except intertidal organisms, killer whale, pigeon guillemot, sea otter, subtidal organisms, Pacific herring, river otter, rockfish, commercial and sport fishing, and subsistence. Many of these restoration options apply to several species.

Affected Natural Resources/Services	Restoration Option
Black oystercatcher	40.0 Special designations
Common murre	4.1 Reduce disturbance at marine bird colonies
Harbor seal	4.2 Reduce disturbance at marine mammal haulouts
Harlequin duck <sup>2</sup>	37.0 Habitat protection and acquisition
Bald eagle <sup>2</sup>	37.0 Habitat protection and acquisition
Cutthroat trout <sup>2</sup>	19.0 Anadromous Streams Catalogue 37.0 Habitat protection and acquisition
Dolly varden <sup>2</sup>	19.0 Anadromous Streams Catalogue 37.0 Habitat protection and acquisition
Marbled murrelet <sup>2</sup>	37.0 Habitat protection and acquisition 40.0 Special designations
Pink salmon <sup>2</sup>	37.0 Habitat protection and acquisition 40.0 Special designations
Archaeology	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts
Recreation <sup>2</sup>	37.0 Habitat protection and acquisition 40.0 Special designations
Wilderness <sup>2</sup>	37.0 Habitat protection and acquisition 40.0 Special designations
Multiple resources	44.0 Spill prevention and contingency planning

Monitoring and information programs are included in all alternatives.

Functional equivalents of injured resources and services are included in all alternatives.

<sup>1</sup>Protect injured resources and services from further degradation or disturbance.

<sup>2</sup>The primary protective measure is Habitat protection and acquisition.

## Summary of Restoration Alternative 2—Protection<sup>1</sup>

**Monitoring:** The objective of this alternative is to evaluate the effectiveness of specific protection measures used in restoring injured resources and services. Monitoring of injured resources and services would be conducted in conjunction with the establishment of special designations such as refuges, sanctuaries, parks and critical areas, purchase and protection of private lands, protection to reduce disturbance around marine mammal haulcuts, and protection of archaeological sites to deter further degradation of sites and artifacts. This alternative also includes the provision to determine when natural recovery will restore injured resources and services to their pre-spill conditions. It assumes normal agency management and monitoring will not be duplicated.

### Affected Natural Resources

#### A. Marine Mammals

**Killer whales—AB pod:** There are no habitat protection options currently identified that would have notable effects on the AB pod. Although broadly applied protection options such as Special Designations would certainly provide some added protection to the pod.

**Harbor seals:** *Reduce disturbance at marine mammal haulouts (#4)* through interagency coordination to help ensure that harbor seal haulout sites are considered and protected when permitting coastal and marine activities. Existing disturbance levels within the EVOS area are thought to be minimal but applying this option would provide benefits by preventing pup mortality at haulout sites.

**Sea otters:** *Reduce disturbance at marine mammal haulout and concentration areas (#4.0):* There is little information available on how sea otters react to disturbance (such as logging at the head of a highly used bay) so it is difficult to evaluate the ability of this option to prevent habitat degradation. A special study that addresses this problem would provide information on how to implement this option and a *land acquisition* option to benefit sea otters.

#### B. Terrestrial Mammals

**River otters:** *Habitat protection and acquisition (37.0)* provides some protection to the river otter population. No estimates are currently available on the amount of habitat that could be protected, or on the tolerance of otters to disturbance. *Special designations (#40.0):* It is difficult to evaluate the option because we don't know the tolerance of river otters to human activities. We believe this option provides less benefit than acquiring protection on private lands since there are fewer threats to lands already publicly managed.

#### C. Birds

**Bald eagles:** *Habitat protection and acquisition (#37)* would ensure that the degree of recovery is equal to the pre-spill population level. The bald eagle population in PWS is believed to be at or near the habitat's carrying capacity. Any loss of nesting habitat would likely constitute a corresponding decrease in the population.

**Black oystercatchers:** *Special designations (#40)* to protect areas where black oystercatchers concentrate or restricting access to injured beaches with several breeding pairs may improve the rate of recovery between 10 to 24%. Because black oystercatcher habitat is concentrated along the intertidal zone for feeding and breeding, little benefit would be added by purchasing upland habitats. There may be a slight (<10%) improvement in the rate of recovery from *habitat protection and acquisition* in some site specific situations where shoreline activities disturb the nesting birds.

**Common murre:** *Reduce disturbance at marine bird colonies (#4):* This option could have a beneficial effect (10–24%) on reducing the amount of recovery time at colonies where human activities disturb the birds during nesting. *Special designations (#40)* would provide the same types of protection but cover a larger area.

<sup>1</sup>Protect injured resources and services from further degradation or disturbance.

**Harlequin ducks:** *Habitat protection and acquisition* is the single most effective option for ensuring the population will recover its pre-spill population at the fastest rate. Studies in the Lower 48 have shown that harlequins are easily disturbed by logging, and other human development, and therefore a proportional loss in breeding birds can be expected.

**Marbled murrelets:** *Habitat protection and Acquisition* provides the greatest benefit in ensuring that the population will recover and prevent more rapid decline. It is conceivable that a large portion of the marbled murrelet population could nest in the prime harvestable timber owned privately, but until more is known about nesting habitat it is impossible to estimate the potential impact from logging or other development.

*Special designations* that include both upland and marine habitats could provide substantial protection to marbled murrelet habitat. A large designation area that would limit development activities and pollution sources may have a positive effect on the prey base.

**Pigeon Guillemots:** Pigeon guillemots are one of the few species that appear to be tolerant of human activity near nesting areas, but it is important to protect the nesting sites from erosion and other degradation. *Protecting upland habitat* immediately adjacent to the coast would prevent the population decline from accelerating due to lost nesting habitat.

#### D. Fish

**Cutthroat trout:** *Update and expand Alaska anadromous stream catalog (#19)* will improve the confidence in the population reaching 100% of its pre-spill levels.

*Habitat protection and acquisition (37)* will prevent substantial losses to the population therefore affecting its degree of recovery. Because PWs cutthroat trout are at the northern extent of their range it is believed that they are more vulnerable to habitat alterations. Large scale development on private lands which would increase the traffic and fishing pressure on nearby populations could cause local (stream-specific) populations to collapse.

**Dolly Varden trout:** *Habitat protection and acquisition (37)* could prevent a 10–20% loss to the population from reduced quality habitat.

**Wild stock Pink salmon:** *Habitat protection and acquisition (#37.0)* could provide protection to 10–30% of the population. This is especially true for areas outside of Prince William Sound where there are more streams with pinks that spawn above the intertidal zone. The added protection may also allow for the population to increase approximately 10% above pre-spill levels.

*Special Designations (#40.0):* The effectiveness of this option to acquiring private lands. No changes would be seen in the rate or degree of recovery. Special designations which protect the large intertidal spawning areas, and prevent degradation from mining activities, could benefit 10–30% of the population.

**Sockeye salmon:** *Habitat protection and acquisition (37.0):* The Kenai river system is already protected from most habitat degrading development. This option could be considered to protect the Quartz Creek area from negative impacts caused by widening the Sterling Highway, but would probably have less than a 10% effect on the overall population. For the Red Lake stock, if this option could be applied to protect the watershed that supports the lake.

#### E. Coastal Habitat

All options that protect coastal areas would benefit the intertidal zones, however, at this time there are no specific protection options targeted at coastal habitat alone.

## Services

- 1. Archaeology.** Restoration of archaeological resources cannot regenerate what has been destroyed, but it can successfully address the prevention of further degradation and loss of both sites and the scientific information they contain. *Site stewardship program, Site patrol and monitoring, and Preservation of archaeological sites and artifacts* are highly effective techniques to protect archaeological resources in the spill-affected area. The last option entails some physical repair and data recovery.
- 2. Recreation.** Both of the restoration actions included for recreation serve primarily to protect existing uses and their resource base. *Habitat protection and Special designations* are the primary means of protecting recreation.
- 3. Wilderness.** *Habitat protection and acquisition* is a highly effective means of preventing additional injury to wilderness; *Special designations* would provide an increased level of resource protection compatible with preservation of wilderness values.

## Summary of Restoration Alternative 3—Limited Restoration<sup>1</sup>

**Monitoring:** Monitoring under this alternative will focus on the need to evaluate the effectiveness of restoration options used in combination including those designed to manage human use, to directly manipulate injured resources and services, to protect or acquire critical habitat, and to replace or acquire the equivalent of injured resources and services. Monitoring of this type is designed to identify where additional restoration activities may be appropriate, and determine when injury is delayed.

Monitoring will be conducted on and in surface waters, tidelands, and on adjacent uplands including their watersheds in Prince William Sound and the Gulf of Alaska. Monitoring also will be conducted outside the spill affected area to measure the effectiveness of replacement and acquisition of equivalent resources and services options, e.g., eliminate predators from marine bird colonies in the Aleutian Islands. This option would also benefit other species that are preyed upon by the gulls and weasels. Even though implementing this option for either murres or guillemots would not have a long-term effect on the predator population there is obviously a negative ecological cost to the predators. Therefore, the ecological costs and benefits will be carefully weighed to determine if the option should be implemented.

**Restoration Options:** Among the many restoration ideas suggested by scientist, agencies, and the public, twenty-one meet the criteria for this alternative. There is at least one effective restoration action for each injured resource or service except black oystercatchers and subtidal organisms. Table \_\_\_ lists restoration options by resource or service. These options are presented as potential projects which have already been evaluated; they are not proposals. Over time, other options are likely to be proposed which may be superior to those listed here.

In this alternative, *Transplanting hatchery runs* for commercial and sport fishing would continue only until the wild stocks of salmon recover to prespill levels. *Testing subsistence foods for hydrocarbon contamination* and providing access to traditional foods in areas outside the spill-affected area would be continued only until subsistence resources and use return to prespill levels. *New backcountry public recreation facilities* would be provided only if they protect existing recreational uses and the resource base on which they depend. Facilities that increase use or create a new use would not be supported with settlement funds. *Habitat Protection and Acquisition* would apply to only the following resources and services:

Harlequin duck  
Marbled murrelet

Recreation  
Wilderness

Resource/Service	Restoration Option
Black oystercatchers	None identified
Common murres	16.1 Study: Increase productivity with social stimuli 17.2 Temporary predator control
Harbor seals	46.0 Cooperative program with commercial fisherman 47.0 Cooperative program with subsistence users
Harlequin duck	13.1 Study: Eliminate oil from mussel beds 37.0 Habitat protection and acquisition
Intertidal organisms	14.0 Accelerate recovery of upper intertidal zone
Marbled murrelet	9.0 Minimize incidental take 37.0 Habitat protection and acquisition 40.0 Land and water management actions
Pigeon guillemots	17.2 Temporary predator control
Sea otters	4.2 Study: Reduce disturbance at marine mammal haul-outs 13.2 Study: Eliminate oil from mussel beds 47.0 Cooperative program with subsistence users

<sup>1</sup>Monitoring and information programs are included in all alternatives.

Restoration actions may be undertaken for injured resources, services, or their equivalents in all alternatives.

Sockeye salmon	2.5 Intensify sockeye management to protect injured stocks 48.0 Improve survival of salmon eggs and fry
Subtidal organisms	None identified
Archaeology	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts
Commercial fishing	18.0 Replace salmon harvest opportunities
Recreation	12.1 New backcountry public recreation facilities 37.0 Habitat protection and acquisition 40.0 Land and water management actions
Sport fishing	18.0 Replace salmon harvest opportunities
Subsistence	30.0 Test subsistence foods for hydrocarbon contamination 49.0 Provide access to traditional subsistence foods
Wilderness and Nonuse values	37.0 Habitat protection and acquisition 40.0 Land and water management actions

## Summary of Restoration Alternative 3—Limited Restoration<sup>1</sup>

**Monitoring:** The goal of this alternative is for the worst-injured resources and services to return to prespill conditions as efficiently as possible. This is the only alternative that limits the scope to resources whose populations declined after the spill. Table \_\_\_ lists the resources and services addressed in this alternative. None of the resources whose populations declined after the spill has yet recovered. However, as resources recover, settlement funds would no longer be allocated to protecting or restoring them. This alternative includes only the most effective actions for protecting injured resources and restoring them to prespill conditions. It also includes only those actions that protect existing human uses that were injured and the resource base on which they depend. For example, a boat ramp in an area already used to launch boats would protect the beach that supports this type of recreational use.

### Affected Natural Resources

#### A. Marine Mammals

**Killer whales—AB pod:** The AB pod feeds in the area where the Prince William Sound black cod fishery occurs where the whales prey on the fishermen's catch. An option to coordinate, and compensate, fishermen is to *facilitate gear changes in the black cod fishery* from long-lines to pots, which would prevent the whales from marauding the catch and eliminate the need for fishermen to defend their harvest.

**Harbor seals:** The two options which have the greatest potential to benefit harbor seals are coordinating two groups that have the most interaction with the harbor seal population. These groups include managers, researchers, subsistence users, and commercial fisherman. The two options are: *develop a cooperative program with subsistence users*, and *develop a cooperative program with commercial fishermen*.

**Sea otters:** The option believed to have the greatest ability to effect the overall sea otter population is to *develop a cooperative program with subsistence users*. This option would ensure that the sea otter population fully recovers to its prespill level and sustains high harvest levels.

The special study of *eliminating oil from oiled mussel beds* could be highly effective (25% to over 50%) in improving the weaning pups survival and recruitment rates. This option has to be considered as a special study because there are too many unknown factors that influence the potential effectiveness of this option. The current level of exposure of young otters to oil from oiled mussel beds is not known, nor is there information on how much oiled food can be eaten before the toxin levels cause an adverse effect. Without this information this option cannot be adequately evaluated.

#### B. Birds

**Black oystercatchers:** None of the current options proposed for black oystercatchers are expected to reach the effectiveness level required for this alternative.

**Common murre:** At this time, there are no proposed options which are certain to reach the effectiveness level required for this alternative. There are two options with the potential to greatly influence the rate of recovery for common murre. Preliminary work needs to be completed before the effectiveness can be adequately evaluated. These options are as follows. (#16.1) *Enhancing the social stimuli:* enhancing social stimuli may accelerate the rate of recovery by reducing the number of years for the population to return to synchronized and successful breeding. (#17.2) *Predator control to benefit marine birds:* predation and its level of impact on the injured colonies have not been documented, but appear to be a significant problem. (At some colonies predation has been shown to destroy 50% of the eggs.), and this option could greatly affect the breeding success of the colonies.

**Harlequin ducks:** Protecting nesting habitat (#37 *Habitat protection and acquisition*) for harlequin ducks is the most effective technique currently proposed. While it will not improve the rate or degree of recovery, it can prevent habitat loss, which could prevent the population from fully recovering to its prespill level.

<sup>1</sup>Take highly effective actions to protect and restore injured services and resources whose population has declined. Maintain the existing character of the affected area.

*Eliminating oil from oiled mussel beds* (#13) has the potential to improve the rate of recovery of a localized area by 25–50%; however, at this time there are too many unknowns to be certain of its effectiveness, and therefore this would be considered as a Special study.

**Marbled murrelets:** Protecting habitat (options #37 *Habitat protection and acquisition* and #40 *Special designations*) would ensure that the marbled murrelet population could recover to its prespill levels once the population decline is reversed. Protecting the coastal waters could also benefit their prey, which may help stabilize the population more quickly. In localized areas, option #9—*Minimizing incidental take of marine birds*—could provide additional help to stabilize the population.

**Pigeon guillemots:** Option #17.2—*Predator control to benefit marine birds*—has the potential to increase productivity by 25–50% at very site-specific locations; however, predation levels at colonies within the injured area have not been documented, and this option may not be needed should predation levels be low.

### C. Fish

**Sockeye salmon (Kenai River):** Option 2—*Intensify fisheries management to protect injured stocks*—is the single most effective option for aiding and protecting the Kenai river systems. Its primary benefit is in the ability to prevent future overescapement problems, which could greatly exacerbate the current injury level. With this option the risk of overescapements could be reduced from 25% to 10%.

In combination with the above option and under the right environmental conditions, option #48 (*Improve the survival of salmon eggs to fry*) could be very effective for the Kenai river system. Improving survival of salmon eggs to fry could stimulate recovery so the injury is confined to one generation and recovery is complete around the year 2000. In order to implement this option, monitoring of the plankton population and salmon escapement must occur in 1994/95 in order to supplement fry production in 1995.

### D. Coastal Habitat

**Coastal habitat—subtidal:** At this time, no effective options have been identified that could help the recovery of subtidal organisms.

**Coastal habitat—upper intertidal:** Option 14—*Accelerate the recovery of the upper intertidal zone*—may prove to greatly increase the recovery time on a very localized basis. Experts have estimated that the option could increase the rate of recovery by 25 to 50%; however, the techniques are experimental and are not likely to be applied on a broad scale.

## Services

- 1. Archaeology.** Restoration of archaeological resources cannot regenerate what has been destroyed, but it can successfully address the prevention of further degradation and loss of both sites and the scientific information they contain. *Site stewardship program, site patrol and monitoring, and preservation of archaeological sites and artifacts* are highly effective techniques to protect archaeological resources in the spill-affected area. The last option entails some physical repair and data recovery.
- 2. Commercial Fishing.** *Replacing harvest opportunities by creating new hatchery runs* is a highly effective method of replacing commercial fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.
- 3. Recreation.** All three of the restoration actions included for recreation serve primarily to protect existing uses and their resource base. *Habitat protection and special designations* are the primary means of protecting recreation. However, in limited situations *new backcountry public recreation facilities* could protect both recreation and the resources on which it depends by, for example, providing an outhouse in a heavily used area.
- 4. Sport fishing.** *Replacing harvest opportunities by creating new hatchery runs* is a highly effective method of replacing sport fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.

5. **Subsistence.** *Testing subsistence foods* is expected to be an effective way of restoring confidence in the safety of subsistence resources within the spill area. Concern over the safety of subsistence resources is believed to be one of the reasons subsistence harvests have not yet returned to prespill levels. Providing *access to traditional foods* in areas outside the spill-affected area would be a highly effective way of restoring lost use. Both projects would be continued until subsistence resources and use have recovered to prespill levels.

6. **Wilderness.** *Habitat protection and acquisition* is a highly effective means of preventing additional injury to wilderness; *special designations* would provide an increased level of resource protection compatible with preservation of wilderness values.

## Restoration Options Included In Alternative 4—Moderate Restoration<sup>1</sup>

**Monitoring:** Monitoring under this alternative will be conducted to evaluate the effectiveness of restoration options used in combination inclusive of managing human use, directly manipulating resources and services, protecting or acquiring critical habitat, and replacing or acquiring the equivalent of injured resources and services. Monitoring of this type is designed to identify where additional restoration activities may be appropriate and determine when injury is delayed.

This alternative also includes the provision to monitor the dynamics of other ecological components, e.g., those important in the food chain (web) of injured species. This type of monitoring is useful in detecting residual effects of the oil spill many years removed from the event, and it provides a baseline from which to assess impacts of future spills and other disturbances. It also generates a database that facilitates greater understanding of how our changing environment affects the species that we manage and protect.

In this alternative, as for Alternative 3, *transplanting hatchery runs* for commercial and sport fishing would continue only until the wild stocks of salmon recover to prespill levels. *Testing subsistence foods for hydrocarbon contamination* and providing *access to traditional foods* in areas outside the spill-affected area would be continued only until subsistence resources and use return to prespill levels. However, in contrast to Alternative 3 *new backcountry public recreation facilities* would be provided either to protect or increase existing recreational uses. *Habitat protection and acquisition* would apply to only the following resources and services:

Harlequin duck	Bald eagle	Recreation
Marbled murrelet	Cutthroat trout	Wilderness
	Dolly Varden	

For those resources or services where little can be done to accelerate their recovery, e.g., sea otter, Alternative 4 includes provisions to determine when natural recovery will restore injured resources and services to their prespill conditions. It also is assumed that normal agency management and monitoring will not be duplicated.

Resource/Service	Restoration Option
Black oystercatcher	None identified
Common murre	16.1 Study: Increase productivity with enhanced social stimuli 17.1 Removal of introduced species in the Aleutians
Harbor seal	46.0 Cooperative program with fishermen 47.0 Cooperative program with subsistence users
Harlequin duck	13.1 Study: Eliminate oil from mussel beds 37.0 Habitat protection and acquisition
Intertidal organisms	14.0 Accelerate recovery of upper intertidal zone
Marbled murrelet	9.0 Minimize incidental take 37.0 Habitat protection and acquisition 40.0 Land and water management actions
Pigeon guillemot	17.1 Removal of introduced species in the Aleutians 17.2 Temporary predator control
Sea otter	4.2 Study: Reduce disturbance at marine mammal haul-outs 13.2 Study: Eliminate oil from mussel beds 47.0 Cooperative program with subsistence users

<sup>1</sup>No action other than monitoring and normal agency management.

Resource/Service	Restoration Option
Sockeye salmon	2.5 Intensify sockeye management to protect injured stocks 11.2 Fertilize lakes to improve sockeye rearing success 48.0 Improve survival of salmon eggs and fry
Subtidal organisms	None identified
Bald eagle	37.0 Habitat protection and acquisition
Cutthroat trout	2.1 Intensify management to protect injured stocks 37.0 Habitat protection and acquisition
Dolly Varden	2.1 Intensify management to protect injured stocks 37.0 Habitat protection and acquisition
Killer Whale	45.0 Study: Changes in black cod fishery gear
Pacific herring	2.2 Intensify herring management to protect injured stocks
Pink salmon	2.3 Intensify salmon management to protect injured stocks 51.0 Relocate existing hatchery runs
River otter	None identified
Rockfish	2.4 Intensify rockfish management to protect injured stocks
Archaeology	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts 35.0 Acquire replacements for artifacts from the spill area
Commercial fishing	18.0 Replace salmon harvest opportunities
Recreation	12.1 New backcountry public recreation facilities 37.0 Habitat protection and acquisition 40.0 Land and water management actions
Sport fishing	18.0 Replace salmon harvest opportunities
Subsistence	30.0 Test subsistence foods for hydrocarbon contamination 49.0 Provide access to traditional subsistence foods
Wilderness and nonuse values	37.0 Habitat protection and acquisition 40.0 Land and water management options

# Summary of Restoration Alternative 4—Moderate Restoration<sup>1</sup>

**Monitoring:** The goal of this alternative is to promote the efficiency by which natural resources and services are recovered; to allocate settlement funds to protect and restore them; and to include actions to protect existing human uses that were injured and to promote their recovery.

## Affected Natural Resources

### A. Marine Mammals

**Harbor seals:** The two options which have the greatest potential to benefit harbor seals are *Develop a cooperative program with subsistence users* and *Develop a cooperative program with commercial fishermen*. These programs will help provide greater management by coordinating managers, researchers, subsistence users, and commercial fishermen.

**Killer whales—AB pod:** An option to determine the feasibility of *facilitating gear changes in the black cod fishery* from long-lines to pots would prevent the whales from marauding the catch and eliminate the need for fisherman to defend their harvest.

**Sea otters:** The option believed to have the greatest ability to affect the overall sea otter population is to *develop a cooperative program with subsistence users*. This option would help ensure that the sea otter population fully recovers to its prespill level and sustain any changes in harvest levels. In addition, the special study of *eliminating oil from oiled mussel beds* could be highly effective (25% to over 50%) in improving the weanling pups survival and recruitment rates if oiled mussel beds are determined to be a major reason for the poor weanling survival.

### B. Terrestrial Mammals

**River otters:** There are no proposed options that meet the effectiveness level described for this option.

### C. Birds

**Bald eagles:** None of the current options proposed for bald eagles expected to reach the effectiveness level required for this alternative.

**Black oystercatchers:** None of the current options proposed for black oystercatchers expected to reach the effectiveness level required for this alternative.

**Common murre:** At this time, there are no proposed options that are certain to reach the effectiveness level required for this alternative. There are two options that have the potential to greatly influence the rate of recovery for common murre; however, preliminary work would need to be completed before the effectiveness can be adequately evaluated. These options are the following: (#16.1) *Enhancing the social stimuli*, and (#17.2) *Predator control to benefit marine birds*. (Note: greater detail provided in Alternative 3.)

**Harlequin ducks:** Protecting nesting habitat (#37 *Habitat protection and acquisition*) for harlequin ducks can prevent habitat loss, which could prevent the population from fully recovering to its prespill level. In addition, in localized areas the special study *eliminating oil from oiled mussel beds* (#13) has the potential to improve the rate of recovery of a localized area by 25–50%; however, at this time there are too many unknowns to be certain of its effectiveness.

**Marbled murrelets:** Protecting habitat (options #37 *Habitat protection and acquisition* and #40 *Special designations*) would ensure that the marbled murrelet population could recover to its prespill levels once the population decline is reversed. Protecting the coastal waters could also benefit their prey, which may help stabilize the population more quickly. In localized areas, option #9—*Minimizing incidental take of marine birds*—could provide additional help to stabilize the population.

<sup>1</sup>Take the most effective actions to protect and restore all injured resources and services. Increase, to a limited extent, opportunities for human use in the affected area.

**Pigeon guillemots:** The only option currently proposed that has the potential to produce a substantial impact on stabilizing the population needs to have preliminary work completed before the option can be adequately evaluated. Option #17.2—*Predator control to benefit marine birds*—has the potential to increase productivity by 25–50% at very site-specific locations; however, predation levels at colonies within the injured area have not been documented, and this option may not be needed should predation levels be low.

#### D. Fish

**Cutthroat trout:** Option 2—*Intensify fisheries management to protect injured stocks*—would benefit both cutthroat trout and its dependent sport fishery. By determining the maximum sustained yield and documenting fishable areas, the sport fishery could be opened or partially opened as early as 1998. It can also be used to enhance the injured stocks an additional 5–10% above the prespill population level.

*Habitat protection and acquisition* is believed to be especially important for cutthroat trout in Prince William Sound because they are at the northern extent of their geographic range and are believed to be more vulnerable to habitat alterations.

**Dolly Varden trout:** Option 2—*Intensify fisheries management to protect injured stocks*—would benefit the Dolly Varden trout population by determining the maximum sustained yield and documenting the sport fishery. The fishery could be managed to protect injured stocks. It can also be used to enhance the injured stocks an additional 5–10% above the prespill population level.

**Herring:** The extent of injury to herring is still unknown. Option 2—*Intensify fisheries management to protect injured stocks*—could improve the rate and degree of recovery by more than 50% if it is necessary. The option would allow for increased precision in stock assessment, which would allow for manipulation of the harvest levels to counter all but the most extreme levels of injury.

**Pink salmon:** The coded-wire tagging and stock separation information that would be gained from an *intensified fisheries management program (option 2)* would help ensure that the wild stock population fully recover and could accelerate the recovery rate as much as 50% over natural recovery. *Relocating existing hatchery runs (option 51)* could substantially improve the recovery of wild stocks by reducing interception rates by 25–50%. The benefits of this option would be fairly localized.

**Sockeye salmon:** Option 2—*Intensify fisheries management to protect injured stocks*—is the single most effective option for aiding and protecting the Kenai River sockeye. With this option, the risk of overescapements on the Kenai River could be reduced from 25% to 10%. In combination with management and under the right environmental conditions, option #48 (*Improve the survival of salmon eggs to fry*) could be very effective for the Kenai River system. Improving survival of salmon eggs to fry could stimulate recovery so it is complete around the year 2000. Monitoring of the plankton population and salmon escapement must occur in 1994/95 in order to supplement fry production in 1995. Option #11.2,—*Fertilization of lakes to improve sockeye rearing success*—could be applied to Coghill Lake to enhance sockeye production.

**Rockfish:** The only option that would have notable benefits to the rockfish population regardless of the injury level is to *intensify the fisheries management*. The added information will help direct the harvest to compensate for injury from the oil spill.

#### E. Coastal Habitat

**Coastal habitat—subtidal:** At this time, no effective options have been identified that could help the recovery of subtidal organisms.

**Coastal habitat—upper intertidal:** Option 14—*Accelerate the recovery of the upper intertidal zone*—may prove to greatly increase the recovery time on a very localized basis. Experts have estimated that the option could increase the rate of recovery by 25 to 50%; however, the techniques are experimental and are not likely to be applied on a broad scale.

## Services

- 1. Archaeology.** Restoration of archaeological resources cannot regenerate what has been destroyed, but it can successfully address the prevention of further degradation and loss of both sites and the scientific information they contain. *Site stewardship program, site patrol and monitoring, and preservation of archaeological sites and artifacts* are highly effective techniques to protect archaeological resources in the spill-affected area. The last option entails some physical repair and data recovery. *Acquiring replacements for artifacts from the spill area* would be a moderately effective means of preserving and studying artifacts that were taken from the oil spill area prior to the spill and are currently in the possession of museums and agencies.
- 2. Commercial Fishing.** *Replacing harvest opportunities by creating new salmon runs* is a highly effective method of replacing commercial fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.
- 3. Recreation.** Three of the restoration actions included for recreation serve primarily to protect existing uses and their resource base. *Habitat protection* and *special designations* are the primary means of protecting recreation. However, in limited situations *new backcountry public recreation facilities* could protect both recreation and the resources on which it depends by, for example, providing an outhouse in a heavily used area. *Expanding existing visitor centers* is a moderately effective way to disseminate information about spill injuries, recovery, and how the public can modify their uses of the area to maximize recovery.
- 4. Sport fishing.** *Replacing harvest opportunities by creating new salmon runs* is a highly effective method of replacing sport fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.
- 5. Subsistence.** *Testing subsistence foods* is expected to be an effective way of restoring confidence in the safety of subsistence resources within the spill area. Concern over the safety of subsistence resources is believed to be one of the reasons subsistence harvests have not yet returned to prespill levels. Providing *access to traditional foods* in areas outside the spill-affected area would be a highly effective way of restoring lost use. Both projects would be continued until subsistence resources and use have recovered to prespill levels.
- 6. Wilderness.** *Habitat protection and acquisition* is a highly effective means of preventing additional injury to wilderness; *special designations* would provide an increased level of resource protection compatible with preservation of wilderness values.

# Summary of Restoration Alternative 5—Comprehensive Restoration<sup>1</sup>

**Monitoring:** The objectives of this alternative are to assess the effectiveness of restoration options inclusive of managing human uses, directly manipulating resources and services, protecting and acquiring critical habitat, and replacing or acquiring the equivalent of injured resources and services. Monitoring of this type is designed to identify where additional restoration activities may be appropriate, and determine when injury is delayed.

## Affected Natural Resources

### A. Marine Mammals

**Harbor seals (first priority):** At present, disturbance of harbor seals at their haulout sites is not believed to be a significant problem, therefore *reducing disturbance at marine mammal haulout sites (option 4.0)* has less effectiveness than the other two options proposed.

The two options which have the greatest potential to benefit harbor seals are: *Develop a cooperative program with subsistence users*, and *Develop a cooperative program with commercial fishermen*.

**Killer whales—AB pod (first priority):** Determine the feasibility of *facilitating gear changes in the black cod fishery* from long-lines to pots. IF this option is feasible it would prevent the whales from marauding the catch and eliminate the need for fishermen to defend their harvest.

**Sea otters (first priority):** *Develop a cooperative program with subsistence users:* This option would help ensure that the sea otter population fully recovers to its pre-spill level and sustain any changes in harvest levels. In addition, the special study of *Eliminating oil from oiled mussel beds* could be highly effective (25% to over 50%) in improving the weanling pups survival and recruitment rates if oiled mussel beds are determined to be a major reason for the poor weanling survival.

### B. Terrestrial Mammals

**River otters:** If the injury to river otter population is not chronic from reduced habitat quality, then an option to *develop sport and trapping harvest guidelines* could be beneficial in restoring the population.

### C. Birds

**Bald eagles:** *Habitat protection and acquisition* is the only option that is likely to provide direct benefit to the bald eagle population. Because there is already mandatory protection for bald eagles, the benefits from this option will be limited.

**Black oystercatchers (first priority):** *Special designations* that protect areas where black oystercatchers concentrate (usually subadults and failed breeders), or restrict accesses to injured beaches with several breeding pairs may improve the rate of recovery by about 10%.

**Common murre (first priority):** There are two options which have the potential to greatly influence the rate of recovery for common murre; however, preliminary work would need to be completed before the effectiveness can be adequately evaluated. These options are: (#16.1) *Enhancing the social stimuli*, and (#17.2) *Predator control to benefit marine birds*. (note: greater detail provided in Alternative 3.) In addition, a feasibility to examine the effectiveness of *modifying the characteristics of the nesting ledges* may provide another option to improve the recovery rate.

**Harlequin ducks (first priority):** Protecting nesting habitat (#37 *Habitat protection and acquisition*) for harlequin ducks can prevent habitat loss which could prevent the population from fully recovering to its prespill level. In addition, in localized areas the special study *Eliminating oil from oiled mussel beds* (#13) has the potential to improve the rate of recovery of a localized area by 25–50%; however, at this time there are too many unknowns to be certain of its effectiveness.

<sup>1</sup>Take all effective actions to protect, restore, and enhance all injured resources and services. Increase opportunities for human use in the affected area.

**Marbled murrelets (first priority):** Protecting habitat (options #37 *Habitat protection and acquisition* and #40 *Special designations*) would ensure that the marbled murrelet population could recover to its prespill levels once the population decline is reversed. Protecting the coastal waters could also benefit their prey which may help stabilize the population more quickly. In localized areas, option #9 *Minimizing incidental take of marine birds* could provide additional help to stabilize the population.

**Pigeon guillemots (first priority):** Option #17.2 *Predator control to benefit marine birds* has the potential to increase productivity by 25–50% at very site specific locations; however, predation levels at colonies within the injured area have not been documented and this option may not be needed should predation levels be low. Preliminary work must be completed before this option can be adequately evaluated.

## D. Fish

**Cutthroat trout:** Option 2 *Intensify fisheries management to protect injured stocks* would benefit both cutthroat trout and allow the sport fishery to be opened as early as 1998. It can also be used to enhance the injured stocks an additional 5–10% above the pre-spill population level.

*Habitat protection and acquisition* is believed to be especially important for cutthroat trout in Prince William Sound because they are at the northern extent of their geographic range and are believed to be more vulnerable to habitat alterations. Likewise, *updating the Alaska anadromous stream catalog* would help ensure that all injured stocks are identified and protected.

**Dolly Varden trout:** Option 2 *Intensify fisheries management to protect injured stocks* would benefit the Dolly Varden trout population by determining the maximum sustained yield and documenting the sport fishing. The fishery could be managed to protect injured stocks. It can also be used to enhance the injured stocks an additional 5–10% above the pre-spill population level.

**Herring:** The extent of injury to herring is still unknown. Option 2 *Intensify fisheries management to protect injured stocks* could improve the rate and degree of recovery by more than 50% if it is necessary. The option would allow for increased precision in stock assessment which would allow for manipulation of the harvest levels to counter all but the most extreme levels of injury.

**Pink salmon:** The coded-wire tagging and stock separation information that would be gained from an *intensified fisheries management program (option 2)* would help ensure that the wild stock population fully recover and could accelerate the recovery rate as much as 50% over natural recovery. *Relocating existing hatchery runs (option 51)* could substantially improve the recovery of wild stocks by reducing interception rates by 25–50%. The benefits of this option would be fairly localized.

**Rockfish:** The only option that would have notable benefits to the rockfish population regardless of the injury level is to *intensify the fisheries management*. The added information will help direct the harvest to compensate for injury from the oil spill.

**Sockeye salmon—Kenai River and Red Lake (first priority):** Option 2 *Intensify fisheries management to protect injured stocks* is the single most effective option for aiding and protecting the two injured systems. With this option the risk of overescapements on the Kenai River could be reduced from 25% to 10%. In combination with management, and under the right environmental conditions, option #48 (*Improve the survival of salmon eggs to fry*) could be very effective for the Kenai River system. Improving survival of salmon eggs to fry could stimulate recovery so it is complete around the year 2000. Monitoring of the plankton population and salmon escapement must occur in 1994/95 in order to supplement fry production in 1995.

*Improving access to salmon spawning areas by building fish passes or removing barriers (11.3)* can be used to enhance the Red Lake population by 10–24%. In addition *Habitat protection and acquisition* may be used to protect specific areas of the Kenai River drainage or to protect the watershed that feeds into the Red Lake.

## E. Coastal Habitat

**Coastal habitat—subtidal:** At this time, no effective options have been identified that could help the recovery of subtidal organisms.

**Coastal habitat—upper intertidal (first priority):** Option 14—*Accelerate the recovery of the upper intertidal zone* may prove to greatly increase the recovery time on a very localized basis. Experts have estimated that the option could increase the rate of recovery by 25 to 50%; however, the techniques are experimental and are not likely to be applied on a broad scale.

## Services

- 1. Archaeology.** Restoration of archaeological resources cannot regenerate what has been destroyed, but it can successfully address the prevention of further degradation and loss of both sites and the scientific information they contain. *Site stewardship program, Site patrol and monitoring, and Preservation of archaeological sites and artifacts* are highly effective techniques to protect archaeological resources in the spill-affected area. The last option entails some physical repair and data recovery. *Acquiring replacements for artifacts from the spill area* would be a moderately effective means of preserving and studying artifacts which were taken from the oil spill area prior to the spill and are currently in the possession of museums and agencies.
- 2. Commercial Fishing.** *Replacing harvest opportunities by creating new salmon runs* is a highly effective method of replacing commercial fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs could continue after wild stocks recover.
- 3. Recreation.** Three of the restoration actions included for recreation serve primarily to protect existing uses and their resource base. *Habitat protection* and *Special designations* are the primary means of protecting recreation. However, in limited situations *New backcountry public recreation facilities* could protect both recreation and the resources on which it depends by, for example, providing an outhouse in a heavily used area.  
*Planning and marketing new commercial facilities on public land* would be an effective way of encouraging new recreational uses of the spill area. *Creating new visitor centers* or building a *Marine environmental institute* would encourage new uses of the spill area. These options are also effective ways to disseminate information about spill injuries, recovery, and how the public can modify their uses of the area to maximize recovery.
- 4. Subsistence.** *Testing subsistence foods* is expected to be an effective way of restoring confidence in the safety of subsistence resources within the spill area. Providing *Access to traditional foods* in areas outside the spill-affected area would be a highly effective way of restoring lost use. Both projects would be continued until subsistence resources and use have recovered to pre-spill levels.  
*Developing subsistence mariculture sites* and *Funding a shellfish hatchery and technical research center* would benefit subsistence users by providing a source of uncontaminated shellfish for their diets.  
*Replacing harvest opportunities by creating new salmon runs* is an effective method of replacing subsistence harvest opportunities lost due to fishing closures or reduced harvest of species injured by the spill. New runs of salmon could replace other sources of food which are perceived as unsafe to eat, such as some shellfish and marine mammals. The option would result in moderate increases in the rate and recovery of subsistence. In this alternative, the newly created runs could continue after wild stocks recover.
- 5. Wilderness.** *Habitat protection and acquisition* is a highly effective means of preventing additional injury to wilderness; *Special designations* would provide an increased level of resource protection compatible with preservation of wilderness values.

## Restoration Options Included In Alternative 5—Comprehensive Restoration

**Monitoring:** The goal of this alternative is for all injured resources and services to return or exceed prespill levels. This table lists the resources and services addressed in this alternative; they are identical to those addressed in Alternatives 2 and 4. This alternative includes actions that protect existing human uses that were injured and the resource base on which they depend and also those actions that would increase existing use or create new uses. An example of the last item is a new commercial facility on public land that attracts different types of uses than had previously existed there.

**Restoration Options.** Among the many restoration ideas suggested by scientists, agencies, and the public, 38 meet the criteria for this alternative. Of these, 21 are identical to those in Alternative 3; and 7 are identical to those in Alternative 4. There is at least one effective restoration action for each injured resource or service except subtidal organisms. This table lists restoration options by resource or service. These options are presented as potential projects which have already been evaluated; they are not proposals. Over time, other options are likely to be proposed which may be superior to those listed here.

Resources/Services	Restoration Option
Black oystercatcher	14.0 Accelerate recovery of upper intertidal zone 37.0 Habitat protection and acquisition 40.0 Land and water management actions
Common murre	4.1 Reduce disturbance at marine bird colonies 16.1 Study: Increase productivity with enhanced social stimuli 16.2 Study: Improve physical characteristics of nest sites 17.1 Removal of introduced species in Aleutians 17.2 Temporary predator control
Harbor seal	4.2 Reduce disturbance at marine mammal haul-out areas 46.0 Cooperative program with commercial fishermen 47.0 Cooperative program with subsistence users
Harlequin duck	8.1 Develop sport harvest guidelines 13.1 Study: Eliminate oil from mussel beds 37.0 Habitat protection and acquisition
Intertidal organisms	14.0 Accelerate recovery of upper intertidal zone
Marbled murrelet	9.0 Minimize incidental take 37.0 Habitat protection and acquisition 40.0 Land and water management actions
Pigeon guillemot	17.1 Removal of introduced species in the Aleutians 17.2 Temporary predator control
Sea otter	4.2 Study: Reduce disturbance at marine mammal haul-outs 13.2 Study: Eliminate oil from mussel beds 47.0 Cooperative program with subsistence users
Sockeye Salmon	2.5 Intensify sockeye management to protect injured stocks 11.2 Fertilize lakes to improve sockeye rearing success 11.3 Improve access to spawning areas with fish passes, etc. 37.0 Habitat protection and acquisition 48.0 Improve survival of salmon eggs and fry
Subtidal organisms	None identified

<sup>1</sup>No action other than monitoring and normal agency management.

Bald eagle	37.0 Habitat protection and acquisition
Cutthroat trout	2.1 Intensify management to protect injured stocks 19.0 Anadromous stream catalogue 37.0 Habitat protection and acquisition
Dolly Varden trout	2.1 Intensify management to protect injured stocks 37.0 Habitat protection and acquisition
Killer Whale	45.0 Study: Changes in black cod fishery gear
Pacific herring	2.2 Intensify herring management to protect injured stocks
Pink salmon	2.3 Intensify salmon management to protect injured stocks 11.1 Construct spawning channels and instream improvements 11.3 Improve access to spawning areas with fish passes, etc. 19.0 Anadromous streams catalogue 37.0 Habitat protection and acquisition 40.0 Land and water management actions 48.0 Improve survival of salmon eggs and fry 51.0 Relocate existing hatchery runs
River otter	8.2 Develop trapping harvest guidelines
Rockfish	2.4 Intensify rockfish management to protect injured stocks
Archaeology	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts 35.0 Acquire replacements for artifacts from the spill area
Commercial fishing	18.0 Replace salmon harvest opportunities
Recreation	12.1 New backcountry public recreation facilities 12.2 Plan and market public land for commercial recreational facilities 33.0 Visitor centers 34.0 Marine environmental institute 37.0 Habitat protection and acquisition 40.0 Land and water management actions
Sport fishing	18.0 Replace salmon harvest opportunities
Subsistence	18.0 Replace salmon harvest opportunities 30.0 Test subsistence foods for hydrocarbon contamination 49.0 Provide access to traditional subsistence foods 50.1 Develop subsistence mariculture sites 50.2 Develop bivalve shellfish hatchery and research center
Wilderness and non-use values	37.0 Habitat protection and acquisition 40.0 Land and water management actions

<sup>1</sup>No action other than monitoring and normal agency management.