Areas Managed by Alaska DNR, Division of Parks and Outdoor Recreation within the Spill Area

State Marine Parks

Bettles Bay
Boswell Bay
Canoe Passage
Decision Point
Driftwood Bay
Entry Cove
Granite Bay
Horseshoe Bay
Jack Bay
Safety Cove
Sandspit Point
Sawmill Bay
Shoup Bay
South Esther Island
Sunny Cove
Surprise Cove
Thumb Cove
Ziegler Cove

Kodiak Archipelago

Buskin River State Recreation Site
Fort Abercrombie State Historic Site
Pasagshak State Recreation Site
Shuyak Island State Park

Kenai Peninsula

Anchor River State Recreation Area
Anchor River State Recreation Site
Bernice Lake State Recreation Area
Caines Head State Recreation Area
Clam Gulch State Recreation Area
Crooked Creek State Recreation Area
Deep Creek State Recreation Area
Johnson Lake State Recreation Area
Kachemak Bay State Park and Wilderness Park
Kasilof River State Recreation Site
Kenai River Special Management Area
Ninilchik State Recreation Area
Stariski State Recreation Site

Restoration Planning Working Group
Exxon Valdez Restoration Office
645 "G" Street
Anchorage, Alaska 99501

TO: RPWG DATE: May 18, 1993

FROM: V.G. for Veronica Gilbert, Bob Loeffler, Carol Gorbics
Karen Klinge, Ray Thompson

RE; Major Revisions to 5/10/93 Version of Draft Restoration Plan

RPWG met to determine the major changes to be made in the Draft Restoration Plan, and the schedule for preparing camera-ready copy by June 7.

Schedule

5/18 Submit all marginal comments to the primary author of each chapter. We assume that major changes are adequately reflected in this memo.

Meet with the Restoration Team to garner their comments on the 5/10 draft.

5/19 1:11 p.m., RPWG meets to decide 1) structure of Appendix D, 2) certain structural changes in Chapter II, 3) format of plan, 4) RT comments, and, if time permits, 5) suggestions of technical advisors for analysis of comments.

5/20 Distribute revised chapters to RPWG for final review.

5/21 10 a.m., meet to discuss any major issues regarding revisions that have been suggested by RPWG or the RT. [This means you have to review revised chapters very quickly.] After the meeting, make final changes in your chapters. Bob and John will read through it one last time; Veronica will convert the files to Word and give them to Deborah Duback for layout. She needs at least two weeks to complete this task.

5/26 Assemble all the photos you want reproduced in the draft plan. Keep them to a minimum and submit them as black and white prints. [Veronica will coordinate. Karen will put all the photos she collected for the brochure on the RPWG conference table.] Photos will not be added at the last minute.

Major Changes

Structure: The only structural change we discussed was Appendix D, pp. 5-17, which describe the effectiveness of General Restoration. We discussed the importance of treating General Restoration, Habitat Protection, and Monitoring and Research with the same emphasis. However, some members thought the plan itself should link options to alternatives. Consequently, we recommend three options for further discussion at our meeting on 5/19:

1) No change. Use the 5/10 version that discusses all details pertaining to all three categories of restoration activities in appendices.

2) Move Appendix C (Habitat Protection), pp. 5-18 of Appendix D (General Restoration, and Appendix E (Monitoring and Research into the main body of the plan as new chapters IV, V, and VI, respectively.

3) Duplicate only the General Restoration tables in Chapter III.

The RPWG members present at Monday's meeting had no strong preference among these options.

"Dear Citizen" Letter: No change

Chapter I: Page I-2. Explain shoreline survey better. Why were only 21.4 miles surveyed in 1992? If a site was not surveyed, does that mean it wasn't oiled? [**Veronica**]

Fig. I-1. Add beach oiling and EVOS boundaries to oiling map. [**Veronica** will work with Jess; **Bob** will obtain data on oiling near Perryville.]

Table I-1. Update table to reflect Seal Bay purchase, contingent on appraisal. [**Veronica**]

X Page I-1. Delete second sentence of Paragraph 4. [**Ray**--discuss with Bob if you have questions about this.] changed but did not paginate

Chapter II: No change, but this should be a top priority for review when John and Mark complete it and obtain Bob Spies' concurrence.

Chapter III: Page III-3, ¶ 2. Add to the end of this sentence, "In some cases it may be difficult to tell when recovery has occurred." [**Bob**]

Page III-4, ¶ 6. Link the discussion of "Priorities" in this section with that in Chapter IV. [**Bob**]

Page III-9, ¶ 3. Add examples of specific endowments, such as Stewardship endowments (20% of each land purchase for management) or the Sturgulewski research endowment. Also add a brief discussion of options for managing endowments. The big question is whether the Trustees would (or have to) manage it. [**Bob**]

Page III-17, ¶ 3. Reword last sentence. [**Karen**]

Chapter IV: Page IV-1, ¶ 4. Express section B. Process in paragraph form. Bob tried this section out on his RT member, who understood it when it as explained to him in a narrative, but reacted negatively to the bullet form. [**Bob**]

Appendix A: Page A-3. Obtain figures regarding distribution of reimbursement to federal government. [**Ray**] Update all references to this statistic. [**Veronica**]

Page A-2. Try to make this table resemble Table I-1 in the text as much as possible. Specific suggestions are to report the 1992 and 1993 Work Plans separately and to report the credit to Exxon last. [**Veronica**]

Suggestions: 1) Develop an alternative table that includes the items that we think should be considered restoration, and 2) have someone else check the figures. [**Veronica**]

Appendix B: Page B-3, ¶ 2. Revise section on timber sales to reflect more accurate information about salvage sales on the Kenai Peninsula. [**Ray**] Done but did not quantify

Appendix C: Page C-1, ¶ 5 The fourth sentence, "This section outlines the evaluation process used for the imminent threat evaluation," prompted the following suggestion. **Carol** volunteered to handle this project. Be sure to work with Art, who is the primary author of this appendix.

1) Check with HPWG on the status of the comprehensive process.
2) If the comprehensive process is developed well enough to describe in the plan, make sure it is accurately reflected in Appendix C. For example, if HPWG has decided to split out anadromous fish, say so. Also, draw a clear distinction between the comprehensive process (to which the plan applies) and the interim protection process (which has been more visible to the public).
3) If not, then clearly state the difference between the comprehensive process and the interim protection process; that the interim protection process will be described in this appendix; and that the comprehensive process will build on it and be reported in the final plan.
4) Add a section describing Trustee Council actions under the Interim Protection Process.

Appendix D: Page D-2. Collapse list to include only pass/fail criteria that affected outcome. Delete criteria 31, 3, 6, 8, and 10. [**Carol**]

Page D-3. New language on rate and degree of recovery, but not confidence. [**Bob**]

Page D-5. Explain localized benefit, explain the table, and reference options. [**Bob and Carol**]

Page D-28. Drop references to option 10-2. [**Carol**]

Page D-40. List communities that depend substantially on subsistence. [**Carol**]

Page D-36. Revise the title of Option 16 to, "Discourage looting and

vandalism through site stewardship and increased law enforcement and agency presence. Revise the text accordingly. **[Sandy]**

Page D-45. Expand Option 24 to reflect public education programs in general, and not just through visitor centers. **[Sandy]**

Page D-46. Make Option 25 more generic. **[Karen]**

Appendix E: Expend on the Research Program. **[John]**

Editorial: The "draft" in Draft Restoration Plan should always be capitalized.
Page numbers in the main body of the plan are confusing. Either number the pages, tables, and figures consecutively or change chapter numbers to Arabic numerals (e.g., 2-1)

Thompson
5/20/93

Restoration Planning Working Group

EXXON VALDEZ OIL SPILL RESTORATION OFFICE
645 "G" Street
Anchorage, Alaska 99501

TO: RT, RPWG

DATE: May 19, 1993

FROM: Bob Loeffler

TELE: 278-8012
FAX: 276-7178

SUBJECT: Notes from 5/18 & 5/19 RPWG/RT Meeting: Review of Draft Restorat'n Plan

These are the notes from the RPWG/RT meeting reviewing the May 10th version of the Draft Restoration Plan. They are discussed by Chapter. They do not include notes from the draft made by RPWG (see 5/18 notes by Veronica). Also, they do not include RT notes for Appendix E.

Finally, they do not include notes given to me by individual RT members.

Chapter I.

p1, ¶2. 3rd Sentence. Change as, "~~The Annual Wok Plan is a mix of restoration activities to be funded~~ It will be based on the policies and spending guidelines for the Restoration Plan...

¶4, 2nd sentence. Change "doing nothing" to "natural recovery". Add concept that the 5th alternative we do everything we can but are constrained by money. (We noted to RT that we might drop sentence.)

¶5, 1st line. Change "the best way" to "how". 5th line. Change ..."animals, plants, and ~~people~~ human uses injured..." 2nd to last line, change "to prepare a Final Restoration Plan ~~for your review~~ to be presented to the public in the fall of ..."

p2, ¶1. Change 1,200 miles to greater than 1,500 miles.
¶5. Add that there was limited clean-up in 1992 to the paragraph.

Figure I-1. Need to put EVOS area on map. Add either beach oiling or have two maps. In any case, indicate that there was more than the surface oiling in this future. Perhaps have two maps. Leave how to do it up to RPWG.

p3, 2nd & 3rd ¶ under Settlements. Make consistent with "Settlement 101". Change "forgiven" to "remitted (forgiven)". Criminal fine is $150 million. $13 million were paid to the North American Wetlands...and $13 million into the Victims of Crime Act Account. Delete the part about $50 million each paid to US and State. Add a sentence to the end of the paragraph that "In addition, Exxon agreed to pay $50 million to each.....in restitution."

p5, ¶2. Change to, "It *does not* manage fish and wildlife resources or ~~make land~~

~~use decisions~~ manage lands. Fish and game management decisions~~ or land use decisions~~ are made by fish and game boards~~, or by appropriate federal or state agencies~~. The Trustee Council may make recommendations to state and federal agencies, provide funds for state and federal management (add approximate language here like "above normal agency management"), or fund research to provide information to those agencies or other groups. The Trustee Council may also fund the purchase of private land or private property rights.

p5, Table. Eliminate bullets underneath $240 million. Asterisk or otherwise note seal Bay purchase (but don't put in table). Add "governments for remaining past expenditures." Also Veronica checks DOI suggestions, etc. with Balfour (sp), the budget guy.

p7, ¶ on PAG. Get DEIS changes to this paragraph from RAY. Specifically change advise, there are 15 voting and 2 ex-officio members. 1st term began Oct 15, 1993. Say how many PAG meetings there have been and that they have all been in ~~-~~Anchorage.

p8, Issues. Re-order issues by putting those that contain similar thoughts together. In second issue, eliminate "..including socio-economic studies..."

p9, last two sentences. In some cases an environmental assessment or a categorical exclusion from ~~further analysis~~ formal documentation may be appropriate. In any case the documentation of the effects analysis will be submitted to the Trustees~~-~~ Council as a component of Annual Work Plans.

p9. All of EIS sections. Get review by lawyers. Also, wherever it says, "requires and EIS" get lawyers reviews.

Chapter 2. No discussion

Chapter 3.
General:

- Put Option Names/Titles tables into back of the chapter.
- Make sure its clear in those tables that there are no general restoration Options in Alternatives #1 and #2.
- For each alternative, put summary of costs for General Restoration Options that adds up all of the costs for options identified for that alternative. (Expected costs & range). Show how much remaining between that and potential allocation in the alternative as a balance for new options.
- Identify Resources & Services addressed in each alternative.

Add paragraph under Injuries Addressed policy question about whether we should address only the population that was injured, or the specie, but make no changes in comment sheet on the subject.

Specific comments:
p1, ¶2. Last sentence. "That alternative ~~will likely~~ could be made..."

p2, ¶2. Change "gulf of Alaska" to "colonies within the Oil Spill Area" (we can name them if we want to).

¶4, ..."and those that were injured but whose populations ~~did not measurable~~ the scientists were unable to measure a decline." (or something like that).

¶5. Use a different example, other than littleneck and butter claims. Check with Bob Spies to see if scientific studies have been completed to change our assessment of these clams in the injury table. If so, change the table(s).

p4, ¶5. "They would also comply with existing or amended ~~existing~~ land-use plans."

¶6. 1st line: "...it is possible to ~~take one side~~ choose one approach or the other."

Eliminate last paragraph. Add something about other issues you may want to address (priorities & addition to injuries addressed issue) to Comment sheet.

p5, ¶7. 1st sentence. We don't prioritize available land, we prioritize possible areas to protect. RPWG should do the actual wording.

p7, ¶1. last full line, "invertebrates, ~~would~~ could ultimately..."

Section on "Evaluating General Restoration Options for Resources, reference new language for Appendix D.

p8. Under "Recovery Monitoring" or in the intro paragraph, add concept that we monitor natural & aided recovery.

p9. Endowment: Make changes recommended by RPWG. Also, in ¶2, give range of money that 20% represents.

¶3. "~~Few~~ Some of the injured resources and services are unlikely..."

p10, ¶1, line 4. Change "is likely to" to "may".

¶3, delete ¶.

Alternative #1. Make changes to be consistent with the EIS. Get from Ken. Delete "Archaeological resources will not recover. Change second paragraph as, "This alternative is the no-action alternative. ~~required to be part of the draft EIS. Consequently,~~ None of the civil..."

p18, bullets: add a bullet something like, "cooperation of private land owners in managing their lands for restoration purposes."

last ¶, 2nd line. "land parcels" See other comment earlier about prioritizing land parcels. RPWG fixes language.

Add to paragraph (or break into 2 ¶s), examples of less than fee simple purchase and say that they would increase the acreage that could be protected.

Chapter IV.
p1, ¶1. "Project proposals will be solicited..." and put rest of sentence in with Part B. For revision of Part B, use Jerome's changes as modified and discussed into five points by Bob Loeffler.

C. Priorities ¶, change as "...will be incorporated into the ~~annual request for project proposals for the~~ draft Annual Work Plan. Criteria for prioritization ~~have not been finalized, but~~ may emphasize..."

p2, 4th bullet. "Projects that benefit injured resources and services identified in the Restoration Plan but not yet addressed ~~by restoration~~ in Annual Work Plans.

p2, II. Compliance with paragraph. 4th line. Delete everything after "requirements ~~although the Trustee Council...completed.~~" (i.e., delete remainder of that sentence and next.)

Appendix A. -- Allocation
Change by footnoting or otherwise noting seal bay in the text but not in the amount totals. Finish unfinished information. Include schedule of Exxon payments.

Appendix B. -- Affected Environment. Change to be consistent with changes made in EIS. Get from Ray.

Appendix C -- Habitat Protection & Acq.
General Changes:

- Change to emphasize the comprehensive process. That is, show interim threat process as the foundation from which we will make the comprehensive process, it is the basis for the comprehensive process, but there may be some changes. Specifically, we know there are problems concerning
  - Parcel boundaries are driven by logging activities, not ecosystems
  - lumped/splitting problem.

  Discuss changes that we expect to make (show proposed lump/split categories)

- The introduction needs to emphasize that this is both public and private. (Layout is awkward).

- Put in examples to show how the system works. Maybe top five interim threat parcels. Don't use small parcels as examples.

- Table C-1. Show resources & svcs are linked to upland habitat. Show plan categories (not HPWG categories). Later show HPWG analysis categories.

- Tables C-3 & C-4 are interim.

Specific Changes
p2, First full ¶. "One issue ~~facing the Trustees~~ is whether...

p3, last ¶. ~~There will also be~~ Potential economic and social impacts ~~that result from the implementation of this process~~ are analyzed in the draft EIS.

p9, ¶5. Use language from pg 11.

p11. ¶1. 1st line. "...can include making recommendations for changing agency..." "Appropriate protective actions on public lands would be determined by first identifying injured resources and services on ~~public~~ those lands..."

¶4. Delete AMSAs, move NMS to the Federal list and add other federal examples such as NRAs, administrative designations.

Last ¶. "At this time, the Trustee Council has no recommendations for changes in public land and water management ~~are proposed~~. However, agencies may be doing some changes on their own. The Trustee Council may propose changes in the future. ~~final Restoration Plan...~~"

Appendix D - General Restoration
General Changes.

- Need introduction to say what this appendix is, what is there. Need to understand what "evaluation by resource or service means, for example. Make it clear how new options are added to the plan. Put the Brochure information about legal review.

- Put a section in about new options that have been identified but not evaluated. Reference in the text of Chapter III. examples are Pigeon Guillemot boxes, shoreline clean-up (assessment?), and other good ideas gleaned from the '94 project list.

Specific
Delete "Study" in table of contents.
Move "Option Number" in contents from existing location.

p2. Change list of criteria by dividing into ones we used and ones that had no effect.

Crit 5, delete last two lines of comment "~~associated with...~~"

Last criteria, in comment change "secondary" to "other"

p6, Killer Whales. Move rejected options into that part of the appendix.

River otters, 2nd ¶. "...some direct benefits..."

Pam Bermann Memo. This part of the notes describes RT conclusions concerning Pam Bergmann's comments in May 18th memo.

P1, 1st & 2nd bullet. Discussed earlier in planning process. Not rediscussed.

3rd bullet. On costs, do as indicated elsewhere in these notes concerning costs. On geographic information, -- can do it but brought up too late. Thus, should be in final.

p2, 1st bullet. Satisfied by how we will modify plan for costs.

2nd. Can't be done in time.

3rd. Do.

4th. If get info back from Bob Spies, will include it. If not, will include latest version.

5th. Deal with these comments when discuss appendix E.

6th. Do.

7th. Public participation information is included in a page that was left out of copy given to Pam. If comments on it, she will give them to RPWG.

8th. Do.

9th. Do.

10th. Do as possible: Will send to Bob Spies and ask him to do it. If he does not give comments, RPWG will cross-check appendix D with injury to ensure no conflicts.

Last paragraph. Veronica will work with DOI budget officer. Part of the table discussed earlier in these notes.

DRAFT

5/21/93
revised edition 1

Appendix B: Affected Environment

This appendix describes the areas directly affected by the oil spill within the Gulf of Alaska from Prince William Sound to the Kodiak Archipelago, lower Cook Inlet, and the Alaska Peninsula. Part A covers the physical and biological environment including the physical setting, marine, coastal, and terrestrial ecosystems. Part B covers the social, cultural and economic environment in the affected area before and after the spill.

A. PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Physical Setting

The *Exxon Valdez* oil spill area is located in southcentral Alaska encompassing a surface area of approximately 75,000 square miles (125,000 km^2) and includes Prince William Sound, the lower Kenai Peninsula, Kodiak Island, Alaska Peninsula and lower Cook Inlet (see Figure I-1).

The geology of the region is young and relatively unstable; glaciers, earthquakes, and active volcanoes are common. The majority of the oil-spill area has a maritime climate with heavy precipitation, averaging 150 inches (381 cm) annually in Prince William Sound. Much of the area is snow-covered during the winter with up to 21 feet (6.4 m) of snowfall per year in Valdez. Temperatures in the region range from 20° F (4° C) in January to a high of 50° F (13° C) in the summer.

2. Greater Oil Spill Area Ecosystem

The oil-spill region contains a diverse collection of marine, coastal, and terrestrial ecosystems which constitutes one of the largest and least developed regional ecosystems in the United States.

a. Marine Ecosystem

The marine ecosystem in the oil-spill area is characterized by water hundreds of meters deep and cold temperatures. High winds and strong currents provide mixing of waters and can produce 20 m waves. Total primary production in the region may be two to four times greater than in the open ocean. Phytoplankton (usually dominated by diatoms) and euphausiids, copepods, and other zooplankton are distributed in patches and are the major food source for many marine species including whales and salmon. Polychaete annelids

and mollusks dominate a diverse benthic community of more than 200 species to depths of 200 m. Soft corals also occur throughout the region.

Diverse and abundant communities of finfish and shellfish are present throughout the oil spill area. Five species of Pacific salmon (chinook, coho, pink, chum, and sockeye) leave the open ocean to spawn in the intertidal zones and rivers of the region. Abundant saltwater finfish include halibut, sole, flounder, sablefish, pollock, mackerel, and Pacific ocean perch. King, tanner, and Dungeness crabs move to shallower water in summer months for spawning. Shrimp, clams, and scallops are also important shellfish in the region.

Large populations of marine mammals are an important component of the marine ecosystem. The most abundant species are sea lions, harbor seals, sea otters, and whales. An estimated 100,000 marine mammals annually reside in or migrate through the Gulf of Alaska. Many areas within the oil-spill area contain unusually large concentrations of marine mammals, e.g., sea otters in Prince William Sound, sea lions on the Barren Islands, and seals throughout the bays and river deltas of the mainland and Kodiak Island.

b. Coastal Ecosystem

The coastal ecosystem is vital to the health of the greater oil-spill area ecosystem and it connects the highly productive marine ecosystem to the rugged terrestrial ecosystem. It also provides food and shelter for marine and terrestrial organisms. Tectonic and glacial influences have produced an extremely irregular coastline characterized by long beaches and dune ridges backed by high marine terraces. Short meltwater streams and large river deltas add to the diversity of the coastal topography. The supratidal zone is important for marine mammal haul-out areas and many terrestrial species. The intertidal and subtidal zones contain diverse communities of their own and are critically important for maintaining the food chain to both marine and terrestrial organisms.

The intertidal zone is land intermittently exposed and inundated by tides. Inhabitants of the intertidal zone include algae (e.g., *Fucus*), mussels, clams, barnacles, limpets, amphipods, isopods, marine worms, and certain fish species. The intertidal zone is used as a spawning and nursery area by many species of fish and as a feeding ground for a variety of marine organisms (e.g., sea otters, Dungeness crabs, juvenile shrimps, rockfish, cod, and juvenile fishes), terrestrial animals (e.g., bears, river otters, and humans), and birds (e.g., black oystercatchers, harlequin ducks, numerous other species of ducks, and shorebirds).

The subtidal zone extends from the low-tide boundary of the intertidal zone into the open water area. Because the near coastal subtidal community is similar in many respects to the intertidal community, it is considered separately from the marine ecosystem. Inhabitants of the shallow subtidal zone include amphipods, clams, eelgrass, crabs, juvenile cod, *Laminaria* plants, spot shrimp, and many other organisms.

c. Terrestrial Ecosystem

The landform and vegetation of the terrestrial ecosystem vary dramatically, but are all influenced by a history of glaciation. Glaciers are still present at high elevations. At lower elevations, ecological conditions vary between mountainous fjord and glacier-dissected rainforest areas as well as flat coastal deltas of the large rivers.

Terrestrial habitats can be classified into riparian, wetlands, old growth forest (200 yrs. plus), mature forest (70-200 yrs.), intermediate stage forest (40-70 yrs.), early stage forest (0-20 yrs.), lowland shrub, mud flats/gravel/rock, subalpine shrub, alpine shrub-lichen tundra, cliffs, islands in lakes, and snow/ice/glaciers. Inland aquatic habitats include anadromous fish streams and lakes as well as resident fish streams and lakes.

A wide range of bird and mammal species inhabit the terrestrial ecosystem of the oil-spill area and many are often more abundant than anywhere else throughout their range. More than 200 species of birds occur in the oil-spill area with more than 100 being shorebirds and seabirds. Approximately 100 species of these birds are year-round residents. Important nesting and breeding areas include the Copper River Delta, Kenai Peninsula, lower Cook Inlet, and the Kodiak and Afognak Island coasts. Moderate populations of bald eagle and peregrine falcon are present and the endangered Aleutian Canada goose and short-tailed albatross may be seasonal visitors to the area. The oil-spill region contains 33 species of terrestrial mammals including brown and black bear, moose, Sitka blacktail deer, mink, and river otter. In addition to the five species of anadromous Pacific salmon many other fish live in the area's diverse inland aquatic communities including Dolly Varden char, rainbow and cutthroat trouts, lake trout, arctic grayling, whitefish, and burbot.

Of the 15 million acres within the oil-spill area, 1.8 million are private lands. Most of these lands were conveyed from public to private ownership during the last 20 years as a result of the Alaska Native Claims Settlement Act. Lands chosen for conversion to private uses were primarily commercially valuable timber lands. Publicly owned lands include a diverse number of designations, both state and federal. The USDA Forest Service manages Chugach National Forest predominantly for recreation and fish and wildlife. There has been no timber harvest in the Prince William Sound area of the Forest since the mid to late 1970s. Harvests currently planned in the Upper Kenai River drainage focus on the salvage and cleanup of trees killed by the spruce bark beetle. The State of Alaska is also administering small sales of beetle killed timber on its land on the Kenai Peninsula. The National Park Service administers the lands in the Kenai Fjords National Park, Lake Clark National Park and Preserve, Katmai National Park and Preserve, and the Aniakchak National Monument and Preserve. Both the Kenai and Katmai Parks consist of large areas of federally designated wilderness or wilderness study areas. The western Prince William Sound portion of the Chugach National Forest is also a wilderness study area. The Fish and Wildlife Service administers million of acres in the Kenai National Wildlife Refuge (NWR), Kodiak NWR, Alaska/Becharof NWR, and Alaska Maritime NWR.

The spill area includes numerous State classifications including Kachemak Bay State Park and Wilderness Park, Shuyak State Park, and eighteen marine parks; five recreation sites; Fort Abercrombie State Historic Site; the Kenai River Special Management Area; the McNeil River State Game Refuge; and eight State Critical Habitat Areas: Copper River Delta, Tugidak Island, Kachemak Bay, Fox River Flats, Anchor River and Fritz Creek, Clam Gulch, Kalgin Island, and Redoubt Bay.

All of these classified areas are afforded some degree of protection from land uses that could adversely affect the recovery of injured resources and services. Wilderness areas in particular provide strict protection against degradation of the ecosystem.

Land management activities, such as those that involve timber harvesting (either clear-cut logging or selective cutting), may have important consequences for the recovery of injured resources in the oil-spill area. Although timber harvesting is allowed on some federal and state lands, it is the primary activity planned for the some of forested private lands. Operators on state and private lands are required to follow the Forest Practices Act procedures for harvesting to protect water quality, and fish and wildlife habitat.

The populations of some species, such as marbled murrelets, pigeon guillemots, and harbor seals, were declining before the spill. Their rate of decline was accelerated by the spill, but other factors such as variations in climatic conditions, habitat loss, or increased competition for food may also have influenced long-term trends in their health and populations. Other species may have been indirectly affected by changes in food supplies or disruption of their habitats.

Availability of population and habitat data varies from species to species. Federal and state environmental agencies had conducted baseline surveys of some species prior to the oil spill, documenting selected species' populations and critical habitats. Some species have never been inventoried, while others, such as the brown bear and the bald eagle, are counted regularly for management purposes. Much is known about species that have played a historic or economic role in the region, such as salmon.

The draft Environmental Impact Statement and the April 1992 Restoration Framework Document both contain specific life history information on the biological resources occurring in the spill area.

B. SOCIAL, CULTURAL AND ECONOMIC ENVIRONMENT

This section describes the social, cultural and economic conditions of the oil-spill region.

1. Affected Communities

The communities most affected by the *Exxon Valdez* spill are grouped into four regions: the Kenai Peninsula Borough, the Kodiak Island Borough, the Lake and Peninsula Borough, and the Valdez–Cordova Census Area. The effects of the spill differ for each region and its communities. The urban communities within these regions rely on commercial fishing, tourism, government and commercial offices, and agriculture. In contrast, the Native villages are largely dependent upon subsistence hunting and fishing.

The Kenai Peninsula Borough includes both sides of Cook Inlet from the southern tip of the Kenai Peninsula north to the Knik Arm–Turnagain Arm split. The Kenai Peninsula holds 99 percent of the borough's population and most of the area's development because it is linked by roads to Anchorage. Of the borough's 27,338 people, 63% live in Kenai and Soldotna. The southern Kenai Peninsula contains the cities of Homer and Seldovia and the Native villages of Port Graham and Nanwalek.

The Kodiak Island Borough includes the city of Kodiak and the six Native villages of Port Lions, Ouzinkie, Larsen Bay, Karluk, Old Harbor, and Akhiok. The Borough population is between 13,000 and 15,000 and includes Natives of Aleutic background and immigrants from the Philippines and Central America.

The portion of the Lake and Peninsula Borough within the spill area contains three communities, Chignik Bay, Chignik Lagoon, and Chignik Lake. Residents of all three communities are ethnically mixed, Aleut, Russian, and Scandinavian. The economies of the communities are mixed cash-subsistence.

The Prince William Sound region covers an area of about 20,000 square miles of water, ice, and land. Within the oil-spill area are included five communities: Valdez, Cordova, Whittier, Chenega Bay, and Tatitlek. Each is accessible by air or water and all have dock or harbor facilities. Only Valdez is accessible by road. The region has an abundant supply of finfish, shellfish, mammals and pristine wilderness which offers unparalleled outdoor recreation, adventure, and travel.

2. Cultural and Anthropological Resources

Many sites important to the Alaskan culture were injured by the oil spill and cleanup response- mainly through human activity in and around the spill area. Some Alaska Native sites in the spill area are more than 11,000 years old. The sites within the oil-spill area fall within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet. Cook Inlet was originally occupied by the Tanaina Athapaskans. Trade, warfare, ceremonial exchange, and intermarriage led to an exchange of many cultural traits among the Pacific Eskimo, Tanaina, Aleut, Eskimo, Athapaskan, Eyak, and Tlingit Indians.

3. Subsistence

The term "subsistence" refers to a particular pattern of harvesting and using naturally occurring renewable resources. In a subsistence system, land and labor are allocated in accordance with kinship, political or tribal rights, and obligations. Subsistence systems define a relationship with the earth and its resources, provide material sustenance, and form the basis of community life. Subsistence systems depend on natural resources in a manner that Western industrialized societies do not. Alaska is the only state in which a significant proportion of the population lives a subsistence lifestyle.

The economic aspects of the subsistence system are also dependent upon the availability of untainted natural resources. In a subsistence lifestyle, food and other material resources are bartered, shared, and used to supplement supplies from other sources. Subsistence resources are the foundation of the mixed subsistence-cash economy in the subsistence villages in the spill area.

None of the rural communities in the spill area is so isolated or so traditional as to be totally uninvolved in the modern market economy. Most spill area communities are characterized by a mixed subsistence-market economy. This label recognizes that a subsistence sector exists alongside a cash system, and that the socioeconomic system is

viable because the sectors are complementary. Even the most traditional subsistence hunter uses modern rifles, snow machines, metal boats, boat motors, plastic nets, and traps. These goods cannot be acquired without cash.

Communities which rely substantially on subsistence in the spill area are listed below:

Akhiok	Ivanof Bay	Ouzinkie
Chenega Bay	Karluk	Perryville
Chignik Lagoon	Larsen Bay	Port Graham
Chignik Lake	Nanwalek	Port Lions
Chignik Bay	Old Harbor	Tatitlek

6. Commercial Fishing

Commercial fishing within the oil-spill area is divided among several regions which include Prince William Sound; Cook Inlet and the outer Kenai Peninsula area; Kodiak, which surrounds Kodiak and Afognak Islands; and Chignik (Table B-1).

The fishing industry in the oil-spill area is primarily a small-boat near shore fishery in contrast to the offshore highly capitalized fishery. The near shore fishery common in Prince William Sound, Cook Inlet, and Kodiak/Afognak Island area concentrates on salmon, herring, halibut, rockfish, black cod and to a lesser extent on Dungeness, king, and tanner (snow) crab. The offshore fishery located in the western Gulf of Alaska is found well offshore, concentrating on groundfish, king, and tanner crabs.

Table B-1. Fishing districts within the oil spill area.

Region	Gear Type		
	Purse Seine and Beach Seine	Drift Gill Net	Set Net
Prince William Sound	Coghill, Unakwik, Northern, Eastern, Southeastern, Montague, and Southwestern	Coghill, Unakwik, Eshamy, and Copper River	Eshamy
Cook Inlet	Southern, Kamishak, Outer, Eastern, and Chitina Bay Subdistrict	Central	Southern (South side of Kamishak Bay and Port Graham Area), and Central
Kodiak	All districts	Northwest and Alitak	
Chignik	All districts		

7. Commercial Tourism

Tourism is Alaska's third-largest industry behind petroleum production and commercial fishing, and is an industry of growing economic importance to the state.

Surveys have indicated that more than 750,000 people from around the world visited Alaska in 1989. Of this number 521,000 people visited in summer generating $304 million in revenue. The Southcentral region was the major beneficiary of visitor spending, capturing 44% of the $304 million. Many of these visitors participate in the activities listed below.

8. Recreation

The land and water within the oil spill area offer tremendous opportunities for outdoor recreation. Much of the land is in public ownership and is designated as parks, refuges, or forest lands. The area provides recreational opportunities including hunting, fishing, hiking, camping, skiing, sightseeing, backpacking, climbing, dogsledding, snowmobiling, snowshoeing, kayaking, canoeing, power boating, sailing, flightseeing, photographing, and filming to the residents and visitors of the region.

9. Sport Fishing and Hunting

Sport fishing and hunting constitute an important and distinct segment of the recreational activities in the oil-spill area. Sport fishing is one of the most popular recreational activities for both residents and visitors of Alaska. Marine and freshwater systems provide a variety of sport fishing opportunities. Several species of Pacific salmon, rockfish, and halibut inhabit salt water. Dolly Varden char, rainbow and cutthroat trout are found in freshwater streams and lakes. Although sport fishing is popular throughout the state, 70% of Alaska's sport fishing occurs in the Southcentral region, the majority of which is located in the Kenai Peninsula because access by car from Anchorage is relatively easy. The Kenai River is well known for king salmon fishing.

The many wildlife refuges, parks, and the national forest located within the oil-affected region provide tremendous opportunities for hunting. The oil-spill area has many species of big game, including several not found (Dall sheep), or very rare (wolf, wolverine, brown bear, caribou) in the other 49 states. In addition moose, black bears, mountain goats, black-tailed deer, and elk inhabit the oil-spill area. Also abundant are many species of furbearers, ptarmigan, grouse, hare, waterfowl, migratory birds, raptors and marine mammals. Hunting is conducted according to the Alaska State Hunting and Trapping Regulations formulated by Alaska Board of Game. These regulations specify bag limits, seasons, and areas for hunting.

The draft Environmental Impact Statement contains additional information on the social, cultural and economic resources occurring in the spill area.

TO: RPWG

FROM: RAY

MAY 21, 1993

SUBJECT: REVISED APPENDIX B, DRAFT RESTORATION PLAN

This document had been revised without the benefit of the new version of Chapter III for the EIS. This should be available today but I am not holding my breath. The Restoration Team and RPWG comments have been incorporated. Please review and let me know what you think. If necessary I will redo this after reviewing the EIS chapter, and will get the revised version to you.

I have also given the EIS group the Plan Chapter 2. If we come up with any significant changes in it today I will need to alert them. Please keep in touch. Thanks.

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Appendix B: Affected Environment

This appendix describes the areas directly affected by the oil spill within the Gulf of Alaska from Prince William Sound to the Kodiak Archipelago, lower Cook Inlet, and the Alaska Peninsula. Part A covers the physical and biological environment including the physical setting, marine, coastal, and terrestrial ecosystems. Part B covers the social, cultural and economic environment in the affected area before and after the spill.

A. PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Physical Setting

The *Exxon Valdez* oil spill area is located in southcentral Alaska encompassing a surface area of approximately 75,000 square miles (125,000 km^2) and includes Prince William Sound, the lower Kenai Peninsula, Kodiak Island, Alaska Peninsula and lower Cook Inlet (see Figure I-1).

The geology of the region is young and relatively unstable; glaciers, earthquakes, and active volcanoes are common. The majority of the oil-spill area has a maritime climate with heavy precipitation, averaging 150 inches (381 cm) annually in Prince William Sound. Much of the area is snow-covered during the winter with up to 21 feet (6.4 m) of snowfall per year in Valdez. Temperatures in the region range from 20° F (4° C) in January to a high of 50° F (13° C) in the summer.

2. Greater Oil Spill Area Ecosystem

The oil-spill region contains a diverse collection of marine, coastal, and terrestrial ecosystems which constitutes one of the largest and least developed regional ecosystems in the United States.

a. Marine Ecosystem

The marine ecosystem in the oil-spill area is characterized by water hundreds of meters deep and cold temperatures. High winds and strong currents provide mixing of waters and can produce 20 m waves. Total primary production in the region may be two to four times greater than in the open ocean. Phytoplankton (usually dominated by diatoms) and euphausiids, copepods, and other zooplankton are distributed in patches and are the major food source for many marine species including whales and salmon. Polychaete annelids and mollusks dominate a diverse benthic community of more than 200 species to depths of 200 m. Soft corals also occur throughout the region.

Diverse and abundant communities of finfish and shellfish are present throughout the oil spill area. Five species of Pacific salmon (chinook, coho, pink, chum, and sockeye) leave the open ocean to spawn in the intertidal zones and rivers of the region. Abundant saltwater finfish include halibut, sole, flounder, sablefish, pollock, mackerel, and Pacific ocean perch. King, tanner, and Dungeness crabs move to shallower water in summer months for spawning. Shrimp, clams, and scallops are also important shellfish in the region.

Large populations of marine mammals are an important component of the marine ecosystem. The most abundant species are sea lions, harbor seals, sea otters, and whales. An estimated 100,000 marine mammals annually reside in or migrate through the Gulf of Alaska. Many areas within the oil-spill area contain unusually large concentrations of marine mammals, e.g., sea otters in Prince William Sound, sea lions on the Barren Islands, and seals throughout the bays and river deltas of the mainland and Kodiak Island.

b. Coastal Ecosystem

The coastal ecosystem is vital to the health of the greater oil-spill area ecosystem and it connects the highly productive marine ecosystem to the rugged terrestrial ecosystem. It also provides food and shelter for marine and terrestrial organisms. Tectonic and glacial influences have produced an extremely irregular coastline characterized by long beaches and dune ridges backed by high marine terraces. Short meltwater streams and large river deltas add to the diversity of the coastal topography. The supratidal zone is important for marine mammal haul-out areas and many terrestrial species. The intertidal and subtidal zones contain diverse communities of their own and are critically important for maintaining the food chain to both marine and terrestrial organisms.

The intertidal zone is land intermittently exposed and inundated by tides. Inhabitants of the intertidal zone include algae (e.g., *Fucus*), mussels, clams, barnacles, limpets, amphipods, isopods, marine worms, and certain fish species. The intertidal zone is used as a spawning and nursery area by many species of fish and as a feeding ground for a variety of marine organisms (e.g., sea otters, Dungeness crabs, juvenile shrimps, rockfish, cod, and juvenile fishes), terrestrial animals (e.g., bears, river otters, and humans), and birds (e.g., black oystercatchers, harlequin ducks, numerous other species of ducks, and shorebirds).

The subtidal zone extends from the low-tide boundary of the intertidal zone into the open water area. Because the near coastal subtidal community is similar in many respects to the intertidal community, it is considered separately from the marine ecosystem. Inhabitants of the shallow subtidal zone include amphipods, clams, eelgrass, crabs, juvenile cod, *Laminaria* plants, spot shrimp, and many other organisms.

c. Terrestrial Ecosystem

The landform and vegetation of the terrestrial ecosystem vary dramatically, but are all influenced by a history of glaciation. Glaciers are still present at high elevations. At lower elevations, ecological conditions vary between mountainous fjord and glacier-dissected rainforest areas as well as flat coastal deltas of the large rivers.

Terrestrial habitats can be classified into riparian, wetlands, old growth forest (200 yrs. plus), mature forest (70-200 yrs.), intermediate stage forest (40-70 yrs.), early stage forest (0-20 yrs.), lowland shrub, mud flats/gravel/rock, subalpine shrub, alpine shrub-lichen tundra, cliffs, islands in lakes, and snow/ice/glaciers. Inland aquatic habitats include anadromous fish streams and lakes as well as resident fish streams and lakes.

A wide range of bird and mammal species inhabit the terrestrial ecosystem of the oil-spill area and many are often more abundant than anywhere else throughout their range. More than 200 species of birds occur in the oil-spill area with more than 100 being shorebirds and seabirds. Approximately 100 species of these birds are year-round residents. Important nesting and breeding areas include the Copper River Delta, Kenai Peninsula, lower Cook Inlet, and the Kodiak and Afognak Island coasts. Moderate populations of bald eagle and peregrine falcon are present and the endangered Aleutian Canada goose and short-tailed albatross may be seasonal visitors to the area. The oil-spill region contains 33 species of terrestrial mammals including brown and black bear, moose, Sitka blacktail deer, mink, and river otter. In addition to the five species of anadromous Pacific salmon many other fish live in the area's diverse inland aquatic communities including Dolly Varden char, rainbow and cutthroat trouts, lake trout, arctic grayling, whitefish, and turbot.

Of the 15 million acres within the oil-spill area, 1.8 million are private lands. Most of these lands were conveyed from public to private ownership during the last 20 years as a result of the Alaska Native Claims Settlement Act. Lands chosen for conversion to private uses were primarily commercially valuable timber lands. Publicly owned lands include a diverse number of designations, both state and federal. The USDA Forest Service manages Chugach National Forest predominantly for recreation and fish and wildlife. There has been no timber harvest in the Prince William Sound area of the Forest since the mid to late 1970s. Harvests currently planned in the Upper Kenai River drainage focus on the salvage and cleanup of trees killed by the spruce bark beetle. The State of Alaska is also administering small sales of beetle killed timber on its land on the Kenai Peninsula. The National Park Service administers the lands in the Kenai Fjords National Park, Katmai National Park and Preserve, and the Aniakchak National Monument and Preserve. Both the Kenai and Katmai Parks consist of large areas of federally designated wilderness or wilderness study areas. The western Prince William Sound portion of the Chugach National Forest is also a wilderness study area. The Fish and Wildlife Service administers million of acres in the Kenai National Wildlife Refuge (NWR), Kodiak NWR, Alaska/Becharof NWR, and Alaska Maritime NWR.

The spill area includes numerous State classifications including Kachemak Bay State Park and Wilderness Park, Shuyak State Park, and eighteen marine parks; five recreation sites; Fort Abercrombie State Historic Site; the Kenai River Special Management Area; the McNeil River State Game Refuge; and eight State Critical Habitat Areas: Copper River Delta, Tugidak Island, Kachemak Bay, Fox River Flats, Anchor River and Fritz Creek, Clam Gulch, Kalgin Island, and Redoubt Bay.

All of these classified areas are afforded some degree of protection from land uses that could adversely affect the recovery of injured resources and services. Wilderness areas in particular provide strict protection against degradation of the ecosystem.

Land management activities, such as those that involve timber harvesting (either clear-cut logging or selective cutting), may have important consequences for the recovery of injured resources in the oil-spill area. Although timber harvesting is allowed on some federal and state lands, it is the primary activity planned for the some of forested private lands. Operators on state and private lands are required to follow the Forest Practices Act procedures for harvesting to protect water quality, and fish and wildlife habitat.

The populations of some species, such as marbled murrelets, pigeon guillemots, and harbor seals, were declining before the spill. Their rate of decline was accelerated by the spill, but other factors such as variations in climatic conditions, habitat loss, or increased competition for food may also have influenced long-term trends in their health and populations. Other species may have been indirectly affected by changes in food supplies or disruption of their habitats.

Availability of population and habitat data varies from species to species. Federal and state environmental agencies had conducted baseline surveys of some species prior to the oil spill, documenting selected species' populations and critical habitats. Some species have never been inventoried, while others, such as the brown bear and the bald eagle, are counted regularly for management purposes. Much is known about species that have played a historic or economic role in the region, such as salmon.

The draft Environmental Impact Statement and the April 1992 Restoration Framework Document both contain specific life history information on the biological resources occurring in the spill area.

B. SOCIAL, CULTURAL AND ECONOMIC ENVIRONMENT

This section describes the social, cultural and economic conditions of the oil-spill region.

1. Affected Communities

The communities most affected by the *Exxon Valdez* spill are grouped into four regions: the Kenai Peninsula Borough, the Kodiak Island Borough, the Lake and Peninsula Borough, and the Valdez–Cordova Census Area. The effects of the spill differ for each region and its communities. The urban communities within these regions rely on commercial fishing, tourism, government and commercial offices, and agriculture. In contrast, the Native villages are largely dependent upon subsistence hunting and fishing.

The Kenai Peninsula Borough includes both sides of Cook Inlet from the southern tip of the Kenai Peninsula north to the Knik Arm–Turnagain Arm split. The Kenai Peninsula holds 99 percent of the borough's population and most of the area's development because it is linked by roads to Anchorage. Of the borough's 27,338 people, 63% live in Kenai and Soldotna. The southern Kenai Peninsula contains the cities of Homer and Seldovia and the Native villages of Port Graham and Nanwalek.

The Kodiak Island Borough includes the city of Kodiak and the six Native villages of Port Lions, Ouzinkie, Larsen Bay, Karluk, Old Harbor, and Akhiok. The Borough population is

between 13,000 and 15,000 and includes Natives of Aleutic background and immigrants from the Philippines and Central America.

The portion of the Lake and Peninsula Borough within the spill area contains three communities, Chignik Bay, Chignik Lagoon, and Chignik Lake. Residents of all three communities are ethnically mixed, Aleut, Russian, and Scandinavian. The economies of the communities are mixed cash-subsistence.

The Prince William Sound region covers an area of about 20,000 square miles of water, ice, and land. Within the oil-spill area are included five communities: Valdez, Cordova, Whittier, Chenega Bay, and Tatitlek. Each is accessible by air or water and all have dock or harbor facilities. Only Valdez is accessible by road. The region has an abundant supply of finfish, shellfish, mammals and pristine wilderness which offers unparalleled outdoor recreation, adventure, and travel.

2. Cultural and Anthropological Resources

Many sites important to the Alaskan culture were injured by the oil spill and cleanup response- mainly through human activity in and around the spill area. Some Alaska Native sites in the spill area are more than 11,000 years old. The sites within the oil-spill area fall within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet. Cook Inlet was originally occupied by the Tanaina Athapascans. Trade, warfare, ceremonial exchange, and intermarriage led to an exchange of many cultural traits among the Pacific Eskimo, Tanaina, Aleut, Eskimo, Athapascan, Eyak, and Tlingit Indians.

3. Subsistence

The term "subsistence" refers to a particular pattern of harvesting and using naturally occurring renewable resources. In a subsistence system, land and labor are allocated in accordance with kinship, political or tribal rights, and obligations. Subsistence systems define a relationship with the earth and its resources, provide material sustenance, and form the basis of community life. Subsistence systems depend on natural resources in a manner that Western industrialized societies do not. Alaska is the only state in which a significant proportion of the population lives a subsistence lifestyle.

The economic aspects of the subsistence system are also dependent upon the availability of untainted natural resources. In a subsistence lifestyle, food and other material resources are bartered, shared, and used to supplement supplies from other sources. Subsistence resources are the foundation of the mixed subsistence-cash economy in the subsistence villages in the spill area.

None of the rural communities in the spill area is so isolated or so traditional as to be totally uninvolved in the modern market economy. Most spill area communities are characterized by a mixed subsistence-market economy. This label recognizes that a subsistence sector exists alongside a cash system, and that the socioeconomic system is viable because the sectors are complementary. Even the most traditional subsistence

hunter uses modern rifles, snow machines, metal boats, boat motors, plastic nets, and traps. These goods cannot be acquired without cash.

Communities which rely substantially on subsistence in the spill area are listed below:

Akhiok	Ivanof Bay	Ouzinkie
Chenega Bay	Karluk	Perryville
Chignik Lagoon	Larsen Bay	Port Graham
Chignik Lake	Nanwalek	Port Lions
Chignik Bay	Old Harbor	Tatitlek

6. Commercial Fishing

Commercial fishing within the oil-spill area is divided among three census regions: Southcentral, which includes PWS and the outer Kenai Peninsula area; Kodiak, which surrounds Kodiak and Afognak Islands; and Bristol Bay, which includes the area between Kodiak and the Alaskan Peninsula.

The fishing industry in the oil-spill area is primarily a small-boat near shore fishery in contrast to the offshore highly capitalized fishery. The near shore fishery common in Prince William Sound, Cook Inlet, and Kodiak/Afognak Island area concentrates on salmon, herring, halibut, rockfish, black cod and to a lesser extent on Dungeness, king, and tanner (snow) crab. The offshore fishery located in the western Gulf of Alaska is found well offshore, concentrating on groundfish, king, and tanner crabs.

Table B-1. Fishing districts within the oil spill area.

Region	Gear Type		
	Purse Seine and Beach Seine	Drift Gill Net	Set Net
Prince William Sound	Coghill, Unakwik, Northern, Eastern, Southeastern, Montague, and Southwestern	Coghill, Unakwik, Eshamy, and Copper River	Eshamy
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Kodiak	All districts	Northwest and Alitak	
Chignik	All districts		

7. Commercial Tourism

Tourism is Alaska's third-largest industry behind petroleum production and commercial fishing, and is an industry of growing economic importance to the state.

Surveys have indicated that more than 750,000 people from around the world visited Alaska in 1989. Of this number 521,000 people visited in summer generating $304 million in revenue. The Southcentral region was the major beneficiary of visitor spending, capturing 44% of the $304 million. Many of these visitors participate in the activities listed below.

8. Recreation

The land and water within the oil spill area offer tremendous opportunities for outdoor recreation. Much of the land is in public ownership and is designated as parks, refuges, or forest lands. The area provides recreational opportunities including hunting, fishing, hiking, camping, skiing, sightseeing, backpacking, climbing, dogsledding, snowmobiling, snowshoeing, kayaking, canoeing, power boating, sailing, flightseeing, photographing, and filming to the residents and visitors of the region.

9. Sport Fishing and Hunting

Sport fishing and hunting constitute an important and distinct segment of the recreational activities in the oil-spill area. Sport fishing is one of the most popular recreational activities for both residents and visitors of Alaska. Marine and freshwater systems provide a variety of sport fishing opportunities. Several species of Pacific salmon, rockfish, and halibut inhabit salt water. Dolly Varden char, rainbow and cutthroat trout are found in freshwater streams and lakes. Although sport fishing is popular throughout the state, 70% of Alaska's sport fishing occurs in the Southcentral region, the majority of which is located in the Kenai Peninsula because access by car from Anchorage is relatively easy. The Kenai River is well known for king salmon fishing.

The many wildlife refuges, parks, and the national forest located within the oil-affected region provide tremendous opportunities for hunting. The oil-spill area has many species of big game, including several not found (Dall sheep), or very rare (wolf, wolverine, brown bear, caribou) in the other 49 states. In addition moose, black bears, mountain goats, black-tailed deer, and elk inhabit the oil-spill area. Also abundant are many species of furbearers, ptarmigan, grouse, hare, waterfowl, migratory birds, raptors and marine mammals. Hunting is conducted according to the Alaska State Hunting and Trapping Regulations formulated by Alaska Department of Fish and Game, Board of Game Members. These regulations specify bag limits and season area-wise for hunting.

The draft Environmental Impact Statement contains additional information on the social, cultural and economic resources occurring in the spill area.

Appendix B: Affected Environment

This appendix describes the areas directly affected by the oil spill within the Gulf of Alaska from Prince William Sound to the Kodiak Archipelago, lower Cook Inlet, and the Alaska Peninsula. Part A covers the physical and biological environment including the physical setting, marine, coastal, and terrestrial ecosystems. Part B covers the social, cultural and economic environment in the affected area before and after the spill.

A. PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Physical Setting

The *Exxon Valdez* oil spill area is located in southcentral Alaska encompassing a surface area of approximately 75,000 square miles (125,000 km^2) and includes Prince William Sound, the lower Kenai Peninsula, Kodiak Island, Alaska Peninsula and lower Cook Inlet (see Figure I-1).

The geology of the region is young and relatively unstable; glaciers, earthquakes, and active volcanoes are common. The majority of the oil-spill area has a maritime climate with heavy precipitation, averaging 150 inches (381 cm) annually in Prince William Sound. Much of the area is snow-covered during the winter with up to 21 feet (6.4 m) of snowfall per year in Valdez. Temperatures in the region range from 20° F (4° C) in January to a high of 50° F (13° C) in the summer.

2. Greater Oil Spill Area Ecosystem

The oil-spill region contains a diverse collection of marine, coastal, and terrestrial ecosystems which constitutes one of the largest and least developed regional ecosystems in the United States.

a. Marine Ecosystem

The marine ecosystem in the oil-spill area is characterized by water hundreds of meters deep and cold temperatures. High winds and strong currents provide mixing of waters and can produce 20 m waves. Total primary production in the region may be two to four times greater than in the open ocean. Phytoplankton (usually dominated by diatoms) and euphausiids, copepods, and other zooplankton are distributed in patches and are the major food source for many marine species including whales and salmon. Polychaete annelids and mollusks dominate a diverse benthic community of more than 200 species to depths of 200 m. Soft corals also occur throughout the region.

Diverse and abundant communities of finfish and shellfish are present throughout the oil spill area. Five species of Pacific salmon (chinook, coho, pink, chum, and sockeye) leave the open ocean to spawn in the intertidal zones and rivers of the region. Abundant saltwater finfish include halibut, sole, flounder, sablefish, pollock, mackerel, and Pacific ocean perch. King, tanner, and Dungeness crabs move to shallower water in summer months for spawning. Shrimp, clams, and scallops are also important shellfish in the region.

Large populations of marine mammals are an important component of the marine ecosystem. The most abundant species are sea lions, harbor seals, sea otters, and whales. An estimated 100,000 marine mammals annually reside in or migrate through the Gulf of Alaska. Many areas within the oil-spill area contain unusually large concentrations of marine mammals, e.g., sea otters in Prince William Sound, sea lions on the Barren Islands, and seals throughout the bays and river deltas of the mainland and Kodiak Island.

b. Coastal Ecosystem

The coastal ecosystem is vital to the health of the greater oil-spill area ecosystem and it connects the highly productive marine ecosystem to the rugged terrestrial ecosystem. It also provides food and shelter for marine and terrestrial organisms. Tectonic and glacial influences have produced an extremely irregular coastline characterized by long beaches and dune ridges backed by high marine terraces. Short meltwater streams and large river deltas add to the diversity of the coastal topography. The supratidal zone is important for marine mammal haul-out areas and many terrestrial species. The intertidal and subtidal zones contain diverse communities of their own and are critically important for maintaining the food chain to both marine and terrestrial organisms.

The intertidal zone is land intermittently exposed and inundated by tides. Inhabitants of the intertidal zone include algae (e.g., *Fucus*), mussels, clams, barnacles, limpets, amphipods, isopods, marine worms, and certain fish species. The intertidal zone is used as a spawning and nursery area by many species of fish and as a feeding ground for a variety of marine organisms (e.g., sea otters, Dungeness crabs, juvenile shrimps, rockfish, cod, and juvenile fishes), terrestrial animals (e.g., bears, river otters, and humans), and birds (e.g., black oystercatchers, harlequin ducks, numerous other species of ducks, and shorebirds).

The subtidal zone extends from the low-tide boundary of the intertidal zone into the open water area. Because the near coastal subtidal community is similar in many respects to the intertidal community, it is considered separately from the marine ecosystem. Inhabitants of the shallow subtidal zone include amphipods, clams, eelgrass, crabs, juvenile cod, *Laminaria* plants, spot shrimp, and many other organisms.

c. Terrestrial Ecosystem

The landform and vegetation of the terrestrial ecosystem vary dramatically, but are all influenced by a history of glaciation. Glaciers are still present at high elevations. At lower elevations, ecological conditions vary between mountainous fjord and glacier-dissected rainforest areas as well as flat coastal deltas of the large rivers.

Terrestrial habitats can be classified into riparian, wetlands, old growth forest (200 yrs. plus), mature forest (70-200 yrs.), intermediate stage forest (40-70 yrs.), early stage forest (0-20 yrs.), lowland shrub, mud flats/gravel/rock, subalpine shrub, alpine shrub-lichen tundra, cliffs, islands in lakes, and snow/ice/glaciers. Inland aquatic habitats include anadromous fish streams and lakes as well as resident fish streams and lakes.

A wide range of bird and mammal species inhabit the terrestrial ecosystem of the oil-spill area and many are often more abundant than anywhere else throughout their range. More than 200 species of birds occur in the oil-spill area with more than 100 being shorebirds and seabirds. Approximately 100 species of these birds are year-round residents. Important nesting and breeding areas include the Copper River Delta, Kenai Peninsula, lower Cook Inlet, and the Kodiak and Afognak Island coasts. Moderate populations of bald eagle and peregrine falcon are present and the endangered Aleutian Canada goose and short-tailed albatross may be seasonal visitors to the area. The oil-spill region contains 33 species of terrestrial mammals including brown and black bear, moose, Sitka blacktail deer, mink, and river otter. In addition to the five species of anadromous Pacific salmon many other fish live in the area's diverse inland aquatic communities including Dolly Varden char, rainbow and cutthroat trouts, lake trout, arctic grayling, whitefish, and turbot.

Of the 15 million acres within the oil-spill area, 1.8 million are private lands. Most of these lands were conveyed from public to private ownership during the last 20 years as a result of the Alaska Native Claims Settlement Act. Lands chosen for conversion to private uses were primarily commercially valuable timber lands. Publicly owned lands include a diverse number of designations, both state and federal. The USDA Forest Service manages Chugach National Forest predominantly for recreation and fish and wildlife. There has been no timber harvest in the Prince William Sound area of the Forest since the mid to late 1970s. Harvests currently planned in the Upper Kenai River drainage focus on the salvage and cleanup of trees killed by the spruce bark beetle. The State of Alaska is also administering small sales of beetle killed timber on its land on the Kenai Peninsula. The National Park Service administers the lands in the Kenai Fjords National Park, Katmai National Park and Preserve, and the Aniakchak National Monument and Preserve. Both the Kenai and Katmai Parks consist of large areas of federally designated wilderness or wilderness study areas. The western Prince William Sound portion of the Chugach National Forest is also a wilderness study area. The Fish and Wildlife Service administers million of acres in the Kenai National Wildlife Refuge (NWR), Kodiak NWR, Alaska/Becharof NWR, and Alaska Maritime NWR.

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All of these classified areas are afforded some degree of protection from land uses that could adversely affect the recovery of injured resources and services. Wilderness areas in particular provide strict protection against degradation of the ecosystem.

Land management activities, such as those that involve timber harvesting (either clear-cut logging or selective cutting), may have important consequences for the recovery of injured resources in the oil-spill area. Although timber harvesting is allowed on some federal and state lands, it is the primary activity planned for the some of forested private lands. Operators on state and private lands are required to follow the Forest Practices Act procedures for harvesting to protect water quality, and fish and wildlife habitat.

The populations of some species, such as marbled murrelets, pigeon guillemots, and harbor seals, were declining before the spill. Their rate of decline was accelerated by the spill, but other factors such as variations in climatic conditions, habitat loss, or increased competition for food may also have influenced long-term trends in their health and populations. Other species may have been indirectly affected by changes in food supplies or disruption of their habitats.

Availability of population and habitat data varies from species to species. Federal and state environmental agencies had conducted baseline surveys of some species prior to the oil spill, documenting selected species' populations and critical habitats. Some species have never been inventoried, while others, such as the brown bear and the bald eagle, are counted regularly for management purposes. Much is known about species that have played a historic or economic role in the region, such as salmon.

The draft Environmental Impact Statement and the April 1992 Restoration Framework Document both contain specific life history information on the biological resources occurring in the spill area.

B. SOCIAL, CULTURAL AND ECONOMIC ENVIRONMENT

This section describes the social, cultural and economic conditions of the oil-spill region.

1. Affected Communities

The communities most affected by the *Exxon Valdez* spill are grouped into four regions: the Kenai Peninsula Borough, the Kodiak Island Borough, the Lake and Peninsula Borough, and the Valdez–Cordova Census Area. The effects of the spill differ for each region and its communities. The urban communities within these regions rely on commercial fishing, tourism, government and commercial offices, and agriculture. In contrast, the Native villages are largely dependent upon subsistence hunting and fishing.

The Kenai Peninsula Borough includes both sides of Cook Inlet from the southern tip of the Kenai Peninsula north to the Knik Arm–Turnagain Arm split. The Kenai Peninsula holds 99 percent of the borough's population and most of the area's development because it is linked by roads to Anchorage. Of the borough's 27,338 people, 63% live in Kenai and Soldotna. The southern Kenai Peninsula contains the cities of Homer and Seldovia and the Native villages of Port Graham and Nanwalek.

The Kodiak Island Borough includes the city of Kodiak and the six Native villages of Port Lions, Ouzinkie, Larsen Bay, Karluk, Old Harbor, and Akhiok. The Borough population is

between 13,000 and 15,000 and includes Natives of Aleutic background and immigrants from the Philippines and Central America.

The portion of the Lake and Peninsula Borough within the spill area contains three communities, Chignik Bay, Chignik Lagoon, and Chignik Lake. Residents of all three communities are ethnically mixed, Aleut, Russian, and Scandinavian. The economies of the communities are mixed cash-subsistence.

The Prince William Sound region covers an area of about 20,000 square miles of water, ice, and land. Within the oil-spill area are included five communities: Valdez, Cordova, Whittier, Chenega Bay, and Tatitlek. Each is accessible by air or water and all have dock or harbor facilities. Only Valdez is accessible by road. The region has an abundant supply of finfish, shellfish, mammals and pristine wilderness which offers unparalleled outdoor recreation, adventure, and travel.

2. Cultural and Anthropological Resources

Many sites important to the Alaskan culture were injured by the oil spill and cleanup response- mainly through human activity in and around the spill area. Some Alaska Native sites in the spill area are more than 11,000 years old. The sites within the oil-spill area fall within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet. Cook Inlet was originally occupied by the Tanaina Athapascans. Trade, warfare, ceremonial exchange, and intermarriage led to an exchange of many cultural traits among the Pacific Eskimo, Tanaina, Aleut, Eskimo, Athapascan, Eyak, and Tlingit Indians.

3. Subsistence

The term "subsistence" refers to a particular pattern of harvesting and using naturally occurring renewable resources. In a subsistence system, land and labor are allocated in accordance with kinship, political or tribal rights, and obligations. Subsistence systems define a relationship with the earth and its resources, provide material sustenance, and form the basis of community life. Subsistence systems depend on natural resources in a manner that Western industrialized societies do not. Alaska is the only state in which a significant proportion of the population lives a subsistence lifestyle.

The economic aspects of the subsistence system are also dependent upon the availability of untainted natural resources. In a subsistence lifestyle, food and other material resources are bartered, shared, and used to supplement supplies from other sources. Subsistence resources are the foundation of the mixed subsistence-cash economy in the subsistence villages in the spill area.

None of the rural communities in the spill area is so isolated or so traditional as to be totally uninvolved in the modern market economy. Most spill area communities are characterized by a mixed subsistence-market economy. This label recognizes that a subsistence sector exists alongside a cash system, and that the socioeconomic system is viable because the sectors are complementary. Even the most traditional subsistence

hunter uses modern rifles, snow machines, metal boats, boat motors, plastic nets, and traps. These goods cannot be acquired without cash.

Communities which rely substantially on subsistence in the spill area are listed below:

Akhiok	Ivanof Bay	Ouzinkie
Chenega Bay	Karluk	Perryville
Chignik Lagoon	Larsen Bay	Port Graham
Chignik Lake	Nanwalek	Port Lions
Chignik Bay	Old Harbor	Tatitlek

6. Commercial Fishing

Commercial fishing within the oil-spill area is divided among three census regions: Southcentral, which includes PWS and the outer Kenai Peninsula area; Kodiak, which surrounds Kodiak and Afognak Islands; and Bristol Bay, which includes the area between Kodiak and the Alaskan Peninsula.

The fishing industry in the oil-spill area is primarily a small-boat near shore fishery in contrast to the offshore highly capitalized fishery. The near shore fishery common in Prince William Sound, Cook Inlet, and Kodiak/Afognak Island area concentrates on salmon, herring, halibut, rockfish, black cod and to a lesser extent on Dungeness, king, and tanner (snow) crab. The offshore fishery located in the western Gulf of Alaska is found well offshore, concentrating on groundfish, king, and tanner crabs.

Table B-1. Fishing districts within the oil spill area.

Region	Gear Type		
	Purse Seine and Beach Seine	Drift Gill Net	Set Net
Prince William Sound	Coghill, Unakwik, Northern, Eastern, Southeastern, Montague, and Southwestern	Coghill, Unakwik, Eshamy, and Copper River	Eshamy
Cook Inlet	Southern, Kamishak, Outer, Eastern, and Chitina Bay Subdistrict	Central	Southern (South side of Kamishak Bay and Port Graham Area), and Central
Kodiak	All districts	Northwest and Alitak	
Chignik	All districts		

7. Commercial Tourism

Tourism is Alaska's third-largest industry behind petroleum production and commercial fishing, and is an industry of growing economic importance to the state.

Surveys have indicated that more than 750,000 people from around the world visited Alaska in 1989. Of this number 521,000 people visited in summer generating $304 million in revenue. The Southcentral region was the major beneficiary of visitor spending, capturing 44% of the $304 million. Many of these visitors participate in the activities listed below.

8. Recreation

The land and water within the oil spill area offer tremendous opportunities for outdoor recreation. Much of the land is in public ownership and is designated as parks, refuges, or forest lands. The area provides recreational opportunities including hunting, fishing, hiking, camping, skiing, sightseeing, backpacking, climbing, dogsledding, snowmobiling, snowshoeing, kayaking, canoeing, power boating, sailing, flightseeing, photographing, and filming to the residents and visitors of the region.

9. Sport Fishing and Hunting

Sport fishing and hunting constitute an important and distinct segment of the recreational activities in the oil-spill area. Sport fishing is one of the most popular recreational activities for both residents and visitors of Alaska. Marine and freshwater systems provide a variety of sport fishing opportunities. Several species of Pacific salmon, rockfish, and halibut inhabit salt water. Dolly Varden char, rainbow and cutthroat trout are found in freshwater streams and lakes. Although sport fishing is popular throughout the state, 70% of Alaska's sport fishing occurs in the Southcentral region, the majority of which is located in the Kenai Peninsula because access by car from Anchorage is relatively easy. The Kenai River is well known for king salmon fishing.

The many wildlife refuges, parks, and the national forest located within the oil-affected region provide tremendous opportunities for hunting. The oil-spill area has many species of big game, including several not found (Dall sheep), or very rare (wolf, wolverine, brown bear, caribou) in the other 49 states. In addition moose, black bears, mountain goats, black-tailed deer, and elk inhabit the oil-spill area. Also abundant are many species of furbearers, ptarmigan, grouse, hare, waterfowl, migratory birds, raptors and marine mammals. Hunting is conducted according to the Alaska State Hunting and Trapping Regulations formulated by Alaska Department of Fish and Game, Board of Game Members. These regulations specify bag limits and season area-wise for hunting.

The draft Environmental Impact Statement contains additional information on the social, cultural and economic resources occurring in the spill area.

Thompson
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Appendix B: Affected Environment

This ~~chapter~~ appendix describes the areas within the Gulf of Alaska from Prince William Sound to the Kodiak Archipelago, lower Cook Inlet, and the Alaska Peninsula directly affected by the oil spill. Part A covers the physical and biological environment including the physical setting, marine, coastal, and terrestrial ecosystems. Part B covers the social and economic environment in the affected area before and after the spill.

A. PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Physical Setting

The *Exxon Valdez* oil spill area is located in southcentral Alaska encompassing a surface area of approximately 75,000 square miles (125,000 km^2) and includes Prince William Sound, the lower Kenai Peninsula, Kodiak Island, Alaska Peninsula and lower Cook Inlet (see Figure __).

reference on reuse Fig I-1

The geology of the region is young and relatively unstable; glaciers, earthquakes, and active volcanoes are common. The majority of the oil-spill area has a maritime climate with heavy precipitation, averaging 150 inches (381 cm) annually in Prince William Sound. Much of the area is snow-covered during the winter, with up to 21 feet (6.4 m) of snowfall per year in Valdez. Temperatures in the region range from ~~approximately~~ 20° F (4° C) in January to a high of ~~approximately~~ 50° F (13° C) in the summer.

2. Greater Oil Spill Area Ecosystem

The oil-spill region contains a diverse ~~system~~ collection of marine, coastal, and terrestrial ecosystems that ~~together~~ constitutes one of the largest and least developed regional ecosystems in the United States.

a. Marine Ecosystem

The marine ecosystem in the oil-spill area is characterized by ~~deep~~ water, hundreds of meters deep and cold temperatures. High winds and strong currents provide mixing of waters and can produce 20 m waves. Total primary production in the region may be two to four times greater than in the open ocean. Phytoplankton (usually dominated by diatoms) and euphausiids, copepods, and other zooplankton are ~~patchily~~ distributed unevenly and are the major food source for many marine species, including whales and salmon. Polychaete annelids and mollusks dominate a diverse benthic community of more than 200 species to depths of 200 m. Soft corals also occur throughout the region.

Diverse and abundant communities of finfish and shellfish are present throughout the oil-spill area. Five species of Pacific salmon (chinook, coho, pink, chum, and sockeye) leave the open ocean to spawn in the intertidal zones and rivers of the region. Abundant saltwater finfish include halibut, sole, flounder, sablefish, pollock, mackerel, and Pacific ocean perch. King, tanner, and Dungeness crabs move to shallower water in summer

months for spawning. Shrimp, clams, and scallops are also important shellfish in the region.

Large populations of marine mammals are an important component of the marine ecosystem. The most abundant species are sea lions, harbor seals, sea otters, and whales. ~~It is~~ estimated ~~that~~ 100,000 marine mammals annually reside in or migrate through the Gulf of Alaska. Many areas within the oil-spill area contain unusually large concentrations of marine mammals, e.g., sea otters in Prince William Sound, sea lions on the Barren Islands, and seals throughout the bays and river deltas of the mainland and Kodiak Island.

b. Coastal Ecosystem

The coastal ecosystem is vital to the health of the greater oil spill area ecosystem, ~~It~~ connects the highly productive marine ecosystem to the rugged terrestrial ecosystem ~~and~~ provides food and shelter for marine and terrestrial organisms. Tectonic and glacial influences have produced an extremely irregular coast characterized by long beaches and dune ridges backed by high marine terraces. Short meltwater streams and large river deltas add to the diversity of the coastal topography. The supratidal zone is important for marine mammal haulout areas and many terrestrial species. The intertidal and subtidal zones contain diverse communities of their own and are critically important for maintaining the food chain to both marine and terrestrial organisms.

The intertidal zone ~~reaches from low to high tide and is~~ intermittently inundated. Inhabitants of the intertidal zone include algae (e.g., *Fucus*), mussels, clams, barnacles, limpets, amphipods, isopods, marine worms, and certain fish species. The intertidal zone is used as a spawning and nursery area by many species of fish and as a feeding ground for a variety of marine organisms (e.g., sea otters, Dungeness crabs, juvenile shrimps, rockfish, cod, and juvenile fishes), terrestrial ~~organisms~~ (e.g., bears, river otters, and humans), and birds (e.g., black oystercatchers, harlequin ducks, numerous other species of ducks, and shorebirds).

The subtidal zone extends from the low tide boundary of the intertidal zone into the open water area. Because the near coastal subtidal community is similar in many respects to the intertidal community, it is considered separately from the marine ecosystem. Inhabitants of the shallow subtidal zone include amphipods, clams, eelgrass, crabs, juvenile cod, *Laminaria* plants, spot shrimp, and many other organisms.

c. Terrestrial Ecosystem

The landform and vegetation of the terrestrial ecosystem vary dramatically, but all are ~~heavily~~ influenced by a history of glaciation. Glaciers are still present at high elevations in all three regions. At lower elevations, ecological conditions vary between mountainous fjord and glacier-dissected rainforest areas ~~and~~ flat coastal deltas of the large rivers.

Terrestrial habitats can be classified into riparian, wetlands, old growth forest (200 yrs. plus), mature forest (70-200 yrs), intermediate stage forest (40-70 yrs), early stage forest (0-20 yrs), lowland shrub, mud flats/gravel/rock, subalpine shrub, alpine shrub-lichen

tundra, cliffs, islands in lakes, and snow/ice/glaciers. Inland aquatic habitats include anadromous fish streams, ~~anadromous~~ and fish lakes, as well as resident fish streams, and ~~resident~~ fish lakes.

A wide range of bird and mammal species inhabit the terrestrial ecosystem of the oil-spill area and many are more abundant ~~there~~ than anywhere else throughout their range. More than 200 species of birds occur in the oil-spill area with more than 100 being shorebirds and seabirds. Approximately 100 species of these birds are year-round residents. Important nesting and breeding areas include the Copper River Delta, Kenai Peninsula, lower Cook Inlet, and the Kodiak and Afognak Island coasts. Moderate populations of bald eagle and peregrine falcon ~~occur~~, and the endangered Aleutian Canada goose and short-tailed albatross may be seasonal visitors to the area. The oil-spill region contains 33 species of terrestrial mammals including brown and black bear, moose, Sitka blacktail deer, mink, and river otter. In addition to the five species of anadromous Pacific salmon (chinook, coho, pink, chum, and sockeye), many other fish ~~contribute~~ to the area's diverse inland aquatic communities including Dolly Varden char, rainbow and cutthroat trouts, lake trout, arctic grayling, whitefish, and turbot.

Of the 15 million acres within the oil-spill area, 1.8 million are private lands. Most of these lands were converted from public to private ownership during the last 20 years as a result of the Alaska Native Claims Settlement Act. Lands chosen for conversion to private uses were primarily commercially-valuable timber lands. Publicly-owned lands include a diverse number of designations, both state and federal. The US Forest Service manages Chugach National Forest predominantly for recreation and fish and wildlife. There have been no timber harvest on the forest since the mid to late 1970s, and no harvests are currently planned. The National Park Service administers the lands in the Kenai Fjords National Park, Katmai National Park and Preserve, and the Aniakchak National Monument and Preserve. Both the Kenai and Katmai Parks consist of large areas of federal designated wilderness or wilderness study areas. The western portion of the Chugach National Forest is also a wilderness study area. The Fish and Wildlife Service administers million of acres in the Kenai National Wildlife Refuge (NWR), Kodiak NWR, Alaska/Becharof NWR, and Alaska Maritime NWR.

The spill area includes numerous State classifications including Kachemak Bay State Park, Shuyak State Park, and nineteen marine parks; the McNeil River State Game Refuge; and eight State Critical Habitat Areas: Copper River Delta, Tugidak Island, Kachemak Bay, Fox River Flats, Anchor River and Fritz Creek, Clam Gulch, Kalgin Island, and Redoubt Bay.

All of these areas are afforded some degree of protection from land uses that could adversely affect ~~or slow~~ the recovery of injured resources and services. Wilderness areas in particular provide strict protection against ~~future~~ degradation of the ecosystem.

Land management activities, such as those that involve timber harvesting (either clear-cut logging or selective cutting), have important consequences for the recovery of injured resources in the oil-spill area. Although timber harvesting is allowed on some federal and State lands, it is the primary activity planned for the some of forested private lands.

The populations of some species, such as marbled murrelets, pigeon guillemots, and harbor seals, were declining before the spill. Their rate of decline was accelerated by the spill, but other factors such as variations in climatic conditions, habitat loss, or increased competition for food may also have influenced long-term trends in their health and populations. Still other species may have been indirectly affected by changes in food supplies or disruption of their habitats.

The availability of population and habitat data varies from species to species. Federal and State environmental agencies had conducted baseline surveys of some native species prior to the oil spill, documenting selected species' populations and critical habitats. Some species have never been inventoried, while others, such as the brown bear and the bald eagle, are counted regularly for management purposes. Much is known about species that have played a significant historic or economic role in the region, such as salmon.

The draft Environmental Impact Statement and the Restoration Framework Document (April 1992) both contain specific life history information on the biological resources occurring in the spill area.

B. SOCIAL AND ECONOMIC ENVIRONMENT

This section describes the social, cultural, and economic conditions of the oil spill region.

1. Affected Communities

The communities most affected by the *Exxon Valdez* spill are grouped into four regions: the Kenai Peninsula Borough, the Kodiak Island Borough, the Lake and Peninsula Borough, and the Valdez–Cordova Census Area. The effects of the spill differ for each region and its communities. The more urban communities within these regions rely on commercial fishing, tourism, government and commercial offices, and agriculture. In contrast, the Native villages are largely dependent upon subsistence hunting and fishing.

The Kenai Peninsula Borough, which is located south of Anchorage, includes both sides of Cook Inlet from the southern tip of the Kenai Peninsula north to the Knik Arm–Turnagain Arm split. The Kenai Peninsula holds 99 percent of the borough's population and most of the area's development because it is linked by roads to Anchorage. Sixty-three percent of the borough's population (27,338 people) lives in Kenai and Soldotna. The southern Kenai Peninsula contains the cities of Homer and Seldovia and the Native villages of Port Graham and Nanwalek.

The Kodiak Island region includes the city of Kodiak and the six Native villages of Port Lions, Ouzinkie, Larsen Bay, Karluk, Old Harbor, and Akhiok. These communities are part of the Kodiak Island Borough. The borough population is between 13,000 and 15,000 and includes Natives of Aleutic background and immigrants from the Philippines and from Central America.

The portion of the Lake and Peninsula Borough within the spill area contains three communities, Chignik Bay, Chignik Lagoon, and Chignik Lake. Residents of all three

communities are ethnically mixed, Aleut, Russian, and Scandinavian. The economies of the communities are mixed cash-subsistence.

The Prince William Sound region covers an area of about 20,000 square miles of water, ice, and land. Within the oil spill area are included five communities: Valdez, Cordova, Whittier, Chenega Bay, and Tatitlek. Each is accessible by air or water, and all have dock or harbor facilities. Only Valdez is accessible by road.

The region has an abundant supply of fish, shellfish, and marine mammals. These and the other natural resources play an important part in the lives of area residents. In addition, the area is considered by many to be a unique, pristine wilderness, offering unparalleled opportunities for outdoor recreation, adventure, and travel.

2. Cultural and Anthropological resources

Sites important to the Alaskan culture were injured by the oil spill and by the cleanup response, mainly by increasing human activity in and around the spill area. Some Alaska Native sites in the spill area are more than 11,000 years old. The sites within the oil spill area fall within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet. Cook Inlet was originally occupied by the Tanaina Athapaskans. Trade, warfare, ceremonial exchange, and occasional intermarriage led to a sharing of many cultural traits among the Pacific Eskimo, Tanaina, Aleut, Eskimo, Athapaskan, Eyak, and Tlingit Indian tribes.

3. Subsistence

The term "subsistence" refers to a particular pattern of harvesting and using naturally occurring renewable resources. In a subsistence system, land and labor are allocated in accordance with kinship, political, or tribal rights and obligations. Subsistence systems define a relationship with the earth and its resources, shape the economy, provide material sustenance, and form the basis of community life. Subsistence systems depend on natural resources in a way that Western industrialized societies do not. Alaska is the only State in which a significant proportion of the population lives off the land.

The economic aspects of the subsistence system also are dependent upon the availability of untainted natural resources. In a subsistence economy, food and other material resources are bartered, shared, and used to supplement supplies from other sources. Subsistence resources are the foundation of the mixed subsistence-cash economy in the subsistence villages in the spill area.

It should be noted that none of the rural communities in spill area is so isolated or so traditional as to be totally uninvolved in the modern market economy. Most spill area communities are characterized by a mixed subsistence-market economy. This label recognizes that a subsistence sector exists alongside a cash system, and that the socioeconomic system is viable because the sectors are complementary and mutually supportive. Even the most traditional subsistence hunter uses the most modern rifles,

snow machines, boats, boat motors, nets, and traps. ~~he can afford~~. These goods cannot be acquired without cash.

Communities which rely substantially on subsistence in the spill area are listed below:

Akhiok	Ivanof Bay	Ouzinkie
Chenega Bay	Karluk	Perryville
Chignik Lagoon	Larsen Bay	Port Graham
Chignik Lake	Nanwalek	Port Lions
Chignik Bay	Old Harbor	Tatitlek

6. Commercial Fishing

Commercial fishing within the oil-spill area is divided among three census regions: Southcentral, which includes PWS and the outer Kenai Peninsula area; Kodiak, which surrounds Kodiak and Afognak Islands; and Bristol Bay, which includes the area between Kodiak and the Alaskan Peninsula.

The fishing industry in the oil-spill area is primarily a small-boat near-shore fishery in contrast to the offshore highly capitalized fishery. The near shore fishery common in Prince William Sound, Cook Inlet, and Kodiak/Afognak Island area concentrates on ~~seasonal~~ salmon, herring, halibut, rockfish, black cod and to a lesser extent on Dungeness, king, and tanner (snow) crab. The offshore fishery located in the western Gulf of Alaska is found well offshore, concentrating on groundfish, king, and tanner crabs.

Table B-1. Fishing districts in within the oil spill area.

Region	Gear Type		
	Purse Seine and Beach Seine	Drift Gill Net	Set Net
Prince William Sound	Coghill, Unakwik, Northern, Eastern, Southeastern, Montague, and Southwestern	Coghill, Unakwik, Eshamy, and Copper River	Eshamy
Cook Inlet	Southern, Kamishak, Outer, Eastern, and Chitina Bay Subdistrict	Central	Southern (South side of Kamishak Bay and Port Graham Area), and Central
Kodiak	All districts	Northwest and Alitak	
Chignik	All districts		

7. Commercial Tourism

Tourism is Alaska's third-largest industry behind petroleum production and commercial fishing, ~~Tourism was, and is,~~ and is an industry of growing economic importance to the state.

Surveys have indicated that more than 750,000 people visited Alaska in 1989 ~~from~~ around the world ~~and~~ of this number 521,000 people visited during summer generating $304 million in ~~summer~~ revenue ~~alone~~. The Southcentral region was the major beneficiary of visitor spending, capturing 44% of the $304 million. A sentence here on what tourists do in SC Alaska would tie this off. I think they sightsee, cruise and fish.

8. Recreation

Many visitors participate in the activities listed below under recreation.

The land and water with

The oil-spill area offers tremendous opportunities for outdoor recreation. Much of ~~the~~ land in ~~the oil-spill area~~ is in public ownership and is designated as parks, refuges, or forest lands. These areas provide ~~developed and non-developed~~ recreational opportunities including hunting, fishing, hiking, camping, skiing, sightseeing, backpacking, climbing, dogsledding, snowmobiling, snowshoeing, kayaking, canoeing, power boating, sailing, flightseeing, photographing, and filming ~~to the residents and visitors of the region. These recreational opportunities have helped create the growing tourism industry in the region~~.

9. Sport Fishing and Hunting

Sport fishing and ~~sport~~ hunting constitute an important and distinct segment of the recreational activities in the oil-spill ~~region~~. Sport fishing is one of the most popular recreational activity for both residents and visitors of Alaska. Marine and freshwater systems provide a variety of sport-fishing opportunities ~~in the oil-spill region~~. Several species of Pacific salmon, rockfish, and halibut inhabit salt water. ~~Species of~~ Dolly Varden char, rainbow and cutthroat trout are found in freshwater streams and lakes. Although sport fishing is popular throughout the state, ~~seventy percent~~ 70% of Alaska's sport fishing occurs in the Southcentral region, the majority of which ~~occurs~~ is located in the Kenai Peninsula because access by car from Anchorage is relatively easy. The Kenai River is well known for king salmon fishing.

The oil-spill areas have 12 species of big game, including several not found (Dall sheep), or very rare (wolf, wolverine, brown bear, caribou) in the other 49 states. ~~Moose, caribou,~~ moose ~~Dall sheep~~, ~~brown bears~~, black bears, ~~wolves,~~ mountain goats, black-tailed deer, and elk inhabit the oil spill area. Also abundant are many species of furbearers, ptarmigan, grouse, hare, waterfowl, migratory birds, raptors and marine mammals. Hunting is conducted according to the Alaska State Hunting and Trapping Regulations formulated by Alaska Department of Fish and Game, Board of Game Members. These regulations specify bag limits and season area-wise for hunting. The many wildlife refuges, parks, and national forests located within the oil-affected region provide tremendous opportunities for hunting.

The draft Environmental Impact Statement contains additional information on the cultural, social and economic resources occurring in the spill area.

Appendix B: Affected Environment

This chapter describes the areas within the Gulf of Alaska from Prince William Sound to the Kodiak Archipelago, lower Cook Inlet, and the Alaska Peninsula directly affected by the oil spill. Part A covers the physical and biological environment including the physical setting, marine, coastal, and terrestrial ecosystems. Part B covers the social and economic environment in the affected area before and after the spill.

A. PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Physical Setting

The *Exxon Valdez* oil spill area is located in southcentral Alaska encompassing a surface area of approximately 75,000 square miles (125,000 km^2) and includes Prince William Sound, the lower Kenai Peninsula, Kodiak Island, Alaska Peninsula and lower Cook Inlet (see Figure __).

The geology of the region is young and relatively unstable; glaciers, earthquakes, and active volcanoes are common. The majority of the oil spill area has a maritime climate with heavy precipitation, averaging 150 inches (381 cm) annually in Prince William Sound. Much of the area is snow covered in the winter, with up to 21 feet (6.4 m) of snowfall per year in Valdez. Temperatures in the region range from approximately 20° F (4° C) in January to a high of approximately 50° F (13° C) in the summer.

2. Greater Oil Spill Area Ecosystem

The oil spill region contains a diverse system of marine, coastal, and terrestrial ecosystems that together constitute one of the largest and least developed regional ecosystems in the United States.

a. Marine Ecosystem

The marine ecosystem in the oil spill area is characterized by deep water (hundreds of meters) and cold temperatures. High winds and strong currents provide mixing of waters and can produce 20 m waves. Total primary production in the region may be two to four times greater than in the open ocean. Phytoplankton (usually dominated by diatoms) and euphausiids, copepods, and other zooplankton are patchily distributed and are the major food source for many marine species, including whales and salmon. Polychaete annelids and mollusks dominate a diverse benthic community of more than 200 species to depths of 200 m. Soft corals also occur throughout the region.

Diverse and abundant communities of finfish and shellfish are present throughout the oil spill area. Five species of Pacific salmon (chinook, coho, pink, chum, and sockeye) leave the open ocean to spawn in the intertidal zones and rivers of the region. Abundant saltwater finfish include halibut, sole, flounder, sablefish, pollock, mackerel, and Pacific ocean perch. King, tanner, and Dungeness crabs move to shallower water in summer

months for spawning. Shrimp, clams, and scallops are also important shellfish in the region.

Large populations of marine mammals are an important component of the marine ecosystem. The most abundant species are sea lions, harbor seals, sea otters, and whales. It is estimated that 100,000 marine mammals annually reside in or migrate through the Gulf of Alaska. Many areas within the oil spill area contain unusually large concentrations of marine mammals, e.g., sea otters in Prince William Sound, sea lions on the Barren Islands, and seals throughout the bays and river deltas of the mainland and Kodiak Island.

b. Coastal Ecosystem

The coastal ecosystem is vital to the health of the greater oil spill area ecosystem. It connects the highly productive marine ecosystem to the rugged terrestrial ecosystem and provides food and shelter for marine and terrestrial organisms. Tectonic and glacial influences have produced an extremely irregular coast characterized by long beaches and dune ridges backed by high marine terraces. Short meltwater streams and large river deltas add to the diversity of the coastal topography. The supratidal zone is important for marine mammal haulout areas and many terrestrial species. The intertidal and subtidal zones contain diverse communities of their own and are critically important for maintaining the food chain to both marine and terrestrial organisms.

The intertidal zone reaches from low to high tide and is intermittently inundated. Inhabitants of the intertidal zone include algae (e.g., *Fucus*), mussels, clams, barnacles, limpets, amphipods, isopods, marine worms, and certain fish species. The intertidal zone is used as a spawning and nursery area by many species of fish and as a feeding ground for a variety of marine organisms (e.g., sea otters, Dungeness crabs, juvenile shrimps, rockfish, cod, and juvenile fishes), terrestrial organisms (e.g., bears, river otters, and humans), and birds (e.g., black oystercatchers, harlequin ducks, numerous other species of ducks, and shorebirds).

The subtidal zone extends from the low tide boundary of the intertidal zone into the open water area. Because the near coastal subtidal community is similar in many respects to the intertidal community, it is considered separately from the marine ecosystem. Inhabitants of the shallow subtidal zone include amphipods, clams, eelgrass, crabs, juvenile cod, *Laminaria* plants, spot shrimp, and many other organisms.

c. Terrestrial Ecosystem

The landform and vegetation of the terrestrial ecosystem vary dramatically, but all are heavily influenced by a history of glaciation. Glaciers are still present at high elevations in all three regions. At lower elevations, ecological conditions vary between mountainous fjord and glacier-dissected rainforest areas and flat coastal deltas of the large rivers.

Terrestrial habitats can be classified into riparian, wetlands, old growth forest (200 yrs plus), mature forest (70-200 yrs), intermediate stage forest (40-70 yrs), early stage forest (0-20 yrs), lowland shrub, mud flats/gravel/rock, subalpine shrub, alpine shrub-lichen

tundra, cliffs, islands in lakes, and snow/ice/glaciers. Inland aquatic habitats include anadromous fish streams, anadromous fish lakes, resident fish streams, and resident fish lakes.

A wide range of bird and mammal species inhabit the terrestrial ecosystem of the oil spill area and many are more abundant there than anywhere else throughout their range. More than 200 species of birds occur in the oil spill area with more than 100 being shorebirds and seabirds. Approximately 100 species of these birds are year-round residents. Important nesting and breeding areas include the Copper River Delta, Kenai Peninsula, lower Cook Inlet, and the Kodiak and Afognak Island coasts. Moderate populations of bald eagle and peregrine falcon occur and the endangered Aleutian Canada goose and short-tailed albatross may be seasonal visitors to the area. The oil spill region contains 33 species of terrestrial mammals including brown and black bear, moose, Sitka blacktail deer, mink, and river otter. In addition to the five species of anadromous Pacific salmon (chinook, coho, pink, chum, and sockeye), many other fish contribute to the areas diverse inland aquatic communities including Dolly Varden char, rainbow and cutthroat trouts, lake trout, arctic grayling, whitefish, and turbot.

Of the 15 million acres within the oil spill area, 1.8 million are private lands. Most of these lands were converted from public to private ownership during the last 20 years as a result of the Alaska Native Claims Settlement Act. Lands chosen for conversion to private uses were primarily commercially valuable timber lands. Publicly owned lands include a diverse number of designations, both state and federal. The USForest Service manages Chugach National Forest predominantly for recreation and fish and wildlife. There have been no timber harvest on the forest since the mid to late 1970s, and no harvests are currently planned. The National Park Service administers the lands in the Kenai Fjords National Park, Katmai National Park and Preserve, and the Aniakchak National Monument and Preserve. Both the Kenai and Katmai Parks consist of large areas of federal designated wilderness or wilderness study areas. The western portion of the Chugach National Forest is also a wilderness study area. The Fish and Wildlife Service administers million of acres in the Kenai National Wildlife Refuge (NWR), Kodiak NWR, Alaska/Becharof NWR, and Alaska Maritime NWR.

The spill area includes numerous State classifications including Katchemak Bay State Park, Shuyak State Park, and nineteen marine parks; the McNeil River State Game Refuge; and eight State Critical Habitat Areas: Cooper River Delta, Tugidak Island, Kachemak Bay, Fox River Flats, Anchor River and Fritz Creek, Clam Gulch, Kalgin Island, and Redoubt Bay.

All of these areas are afforded some degree of protection from land uses that could adversely affect or slow the recovery of injured resources and services. Wilderness areas in particular provide strict protection against future degradation of the ecosystem.

Land management activities, such as those that involve timber harvesting (either clear-cut logging or selective cutting), have important consequences for the recovery of injured resources in the oil spill area. Although timber harvesting is allowed on some Federal and State lands, it is the primary activity planned for the some of forested private lands.

The populations of some species, such as marbled murrelets, pigeon guillemots, and harbor seals, were declining before the spill. Their rate of decline was accelerated by the spill, but other factors such as variations in climatic conditions, habitat loss, or increased competition for food may also have influenced long-term trends in their health and populations. Still other species may have been indirectly affected by changes in food supplies or disruption of their habitats.

The availability of population and habitat data varies from species to species. Federal and State environmental agencies had conducted baseline surveys of some native species prior to the oil spill, documenting selected species' populations and critical habitats. Some species have never been inventoried, while others, such as the brown bear and the bald eagle, are counted regularly for management purposes. Much is known about species that have played a significant historic or economic role in the region, such as salmon.

The draft Environmental Impact Statement and the Restoration Framework Document both contain specific life history information on the biological resources occurring in the spill area.

B. SOCIAL AND ECONOMIC ENVIRONMENT

This section describes the social, cultural, and economic conditions of the oil spill region.

1. Affected Communities

The communities most affected by the *Exxon Valdez* spill are grouped into four regions: the Kenai Peninsula Borough, the Kodiak Island Borough, the Lake and Peninsula Borough, and the Valdez–Cordova Census Area. The effects of the spill differ for each region and its communities. The more urban communities within these regions rely on commercial fishing, tourism, government and commercial offices, and agriculture. In contrast, the Native villages are largely dependent upon subsistence hunting and fishing.

The Kenai Peninsula Borough, which is located south of Anchorage, includes both sides of Cook Inlet from the southern tip of the Kenai Peninsula north to the Knik Arm–Turnagain Arm split. The Kenai Peninsula holds 99 percent of the borough's population and most of the area's development because it is linked by roads to Anchorage. Sixty-three percent of the borough's population (27,338 people) lives in Kenai and Soldotna. The southern Kenai Peninsula contains the cities of Homer and Seldovia and the Native villages of Port Graham and Nanwalek.

The Kodiak Island region includes the city of Kodiak and the six Native villages of Port Lions, Ouzinkie, Larsen Bay, Karluk, Old Harbor, and Akhiok. These communities are part of the Kodiak Island Borough. The borough population is between 13,000 and 15,000 and includes Natives of Aleutic background and immigrants from the Philippines and from Central America.

The portion of the Lake and Peninsula Borough within the spill area contains three communities, Chignik Bay, Chignik Lagoon, and Chignik Lake. Residents of all three

communities are ethnically mixed, Aleut, Russian, and Scandinavian. The economies of the communities are mixed cash-subsistence.

The Prince William Sound region covers an area of about 20,000 square miles of water, ice, and land. Within the oil spill area are included five communities: Valdez, Cordova, Whittier, Chenega Bay, and Tatitlek. Each is accessible by air or water, and all have dock or harbor facilities. Only Valdez is accessible by road.

The region has an abundant supply of fish, shellfish, and marine mammals. These and the other natural resources play an important part in the lives of area residents. In addition, the area is considered by many to be a unique, pristine wilderness, offering unparalleled opportunities for outdoor recreation, adventure, and travel.

2. Cultural and anthropological resources

Sites important to the Alaskan culture were injured by the oil spill and by the cleanup response, mainly by increasing human activity in and around the spill area. Some Alaska Native sites in the spill area are more than 11,000 years old. The sites within the oil spill area fall within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet. Cook Inlet was originally occupied by the Tanaina Athapaskans. Trade, warfare, ceremonial exchange, and occasional intermarriage led to a sharing of many cultural traits among the Pacific Eskimo, Tanaina, Aleut, Eskimo, Athapaskan, Eyak, and Tlingit Indian tribes.

3. Subsistence

The term "subsistence" refers to a particular pattern of harvesting and using naturally occurring renewable resources. In a subsistence system, land and labor are allocated in accordance with kinship, political, or tribal rights and obligations. Subsistence systems define a relationship with the earth and its resources, shape the economy, provide material sustenance, and form the basis of community life. Subsistence systems depend on natural resources in a way that Western industrialized societies do not. Alaska is the only State in which a significant proportion of the population lives off the land.

The economic aspects of the subsistence system also are dependent upon the availability of untainted natural resources. In a subsistence economy, food and other material resources are bartered, shared, and used to supplement supplies from other sources. Subsistence resources are the foundation of the mixed subsistence-cash economy in the subsistence villages in the spill area.

It should be noted that none of the rural communities in spill area is so isolated or so traditional as to be totally uninvolved in the modern market economy. Most spill area communities are characterized by a mixed subsistence-market economy. This label recognizes that a subsistence sector exists alongside a cash system, and that the socioeconomic system is viable because the sectors are complementary and mutually supportive. Even the most traditional subsistence hunter uses the most modern rifles,

snow machines, boats, boat motors, nets, and traps he can afford. These goods cannot be acquired without cash.

Communities which rely substantially on subsistence in the spill area are listed below:

Akhiok	Ivanof Bay	Ouzinkie
Chenega Bay	Karluk	Perryville
Chignik Lagoon	Larsen Bay	Port Graham
Chignik Lake	Nanwalek	Port Lions
Chignik	Old Harbor	Tatitlek

6. Commercial Fishing

Commercial fishing within the oil spill area is divided among three census regions: Southcentral, which includes PWS and the outer Kenai Peninsula area; Kodiak, which surrounds Kodiak and Afognak Islands; and Bristol Bay, which includes the area between Kodiak and the Alaskan Peninsula.

The fishing industry in the oil spill area is primarily a small-boat near shore fishery in contrast to the offshore highly capitalized fishery. The near shore fishery common in Prince William Sound, Cook Inlet, and Kodiak/Afognak Island area concentrates on seasonal salmon, herring, halibut, rockfish, black cod and to a lesser extent on Dungeness, king, and tanner (snow) crab. The offshore fishery located in the western Gulf of Alaska is found well offshore, concentrating on groundfish, king, and tanner crabs.

Table B-1. Fishing districts in within the oil spill area.

Region	Gear Type		
	Purse Seine and Beach Seine	Drift Gill Net	Set Net
Prince William Sound	Coghill, Unakwik, Northern, Eastern, Southeastern, Montague, and Southwestern	Coghill, Unakwik, Eshamy, and Copper River	Eshamy
Cook Inlet	Southern, Kamishak, Outer, Eastern, and Chitina Bay Subdistrict	Central	Southern (South side of Kamishak Bay and Port Graham Area), and Central
Kodiak	All districts	Northwest and Alitak	
Chignik	All districts		

7. Commercial Tourism

Tourism is Alaska's third-largest industry behind petroleum production and commercial fishing. Tourism was, and is, an industry of growing economic importance to the state.

Surveys have indicated that more than 750,000 people visited Alaska in 1989 from around the world and of this number 521,000 people visited in summer generating $304 million in summer revenue alone. The Southcentral region was the major beneficiary of visitor spending, capturing 44% of the $304 million.

8. Recreation

The oil spill area offers tremendous opportunities for outdoor recreation. Much of land in the oil spill area is in public ownership and is designated as parks, refuges, or forest lands. These areas provide developed and non-developed recreational opportunities including hunting, fishing, hiking, camping, skiing, sightseeing, backpacking, climbing, dogsledding, snowmobiling, snowshoeing, kayaking, canoeing, power boating, sailing, flightseeing, photographing, and filming to the residents and visitors of the region. These recreational opportunities have helped create the growing tourism industry in the region.

9. Sport Fishing and Hunting

Sport fishing and sport hunting constitute an important and distinct segment of the recreational activities in the oil spill region. Sport fishing is one of the most popular recreational activity for both residents and visitors of Alaska. Marine and freshwater systems provide a variety of sport fishing opportunities in the oil-spill region. Several species of Pacific salmon, rockfish, and halibut inhabit salt water. Species of Dolly Varden char, rainbow and cutthroat trout are found in freshwater streams and lakes. Although sport fishing is popular throughout the state, seventy percent of Alaska's sport fishing occurs in the Southcentral region, the majority of which occurs the Kenai Peninsula because access by car from Anchorage is relatively easy. The Kenai River is well known for king salmon fishing.

The oil spill areas have 12 species of big game, including several not found (Dall sheep), or very rare (wolf, wolverine, brown bear, caribou) in the other 49 states. Moose, caribou, Dall sheep, brown bears, black bears, wolves, mountain goats, black-tailed deer, and elk inhabit the oil spill area. Also abundant are many species of furbearers, ptarmigan, grouse, hare, waterfowl, migratory birds, raptors and marine mammals. Hunting is conducted according to the Alaska State Hunting and Trapping Regulations formulated by Alaska Department of Fish and Game, Board of Game Members. These regulations specify bag limits and season area-wise for hunting. The many wildlife refuges, parks, and national forests located within the oil-affected region provide tremendous opportunities for hunting.

The draft Environmental Impact Statement contains additional information on the cultural, social and economic resources occurring in the spill area.

Appendix B: Affected Environment

This chapter describes the areas within the Gulf of Alaska from Prince William Sound to the Kodiak Archipelago, lower Cook Inlet, and the Alaska Peninsula directly affected by the oil spill. Part A covers the physical and biological environment including the physical setting, marine, coastal, and terrestrial ecosystems. Part B covers the social and economic environment in the affected area before and after the spill.

A. PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Physical Setting

The *Exxon Valdez* oil spill area is located in southcentral Alaska encompassing a surface area of approximately 75,000 square miles (125,000 km^2) and includes Prince William Sound, the lower Kenai Peninsula, Kodiak Island, Alaska Peninsula and lower Cook Inlet (see Figure __).

The geology of the region is young and relatively unstable; glaciers, earthquakes, and active volcanoes are common. The majority of the oil spill area has a maritime climate with heavy precipitation, averaging 150 inches (381 cm) annually in Prince William Sound. Much of the area is snow covered in the winter, with up to 21 feet (6.4 m) of snowfall per year in Valdez. Temperatures in the region range from approximately 20° F (4° C) in January to a high of approximately 50° F (13° C) in the summer.

2. Greater Oil Spill Area Ecosystem

The oil spill region contains a diverse system of marine, coastal, and terrestrial ecosystems that together constitute one of the largest and least developed regional ecosystems in the United States.

a. Marine Ecosystem

The marine ecosystem in the oil spill area is characterized by deep water (hundreds of meters) and cold temperatures. High winds and strong currents provide mixing of waters and can produce 20 m waves. Total primary production in the region may be two to four times greater than in the open ocean. Phytoplankton (usually dominated by diatoms) and euphausiids, copepods, and other zooplankton are patchily distributed and are the major food source for many marine species, including whales and salmon. Polychaete annelids and mollusks dominate a diverse benthic community of more than 200 species to depths of 200 m. Soft corals also occur throughout the region.

Diverse and abundant communities of finfish and shellfish are present throughout the oil spill area. Five species of Pacific salmon (chinook, coho, pink, chum, and sockeye) leave the open ocean to spawn in the intertidal zones and rivers of the region. Abundant saltwater finfish include halibut, sole, flounder, sablefish, pollock, mackerel, and Pacific ocean perch. King, tanner, and Dungeness crabs move to shallower water in summer

months for spawning. Shrimp, clams, and scallops are also important shellfish in the region.

Large populations of marine mammals are an important component of the marine ecosystem. The most abundant species are sea lions, harbor seals, sea otters, and whales. It is estimated that 100,000 marine mammals annually reside in or migrate through the Gulf of Alaska. Many areas within the oil spill area contain unusually large concentrations of marine mammals, e.g., sea otters in Prince William Sound, sea lions on the Barren Islands, and seals throughout the bays and river deltas of the mainland and Kodiak Island.

b. Coastal Ecosystem

The coastal ecosystem is vital to the health of the greater oil spill area ecosystem. It connects the highly productive marine ecosystem to the rugged terrestrial ecosystem and provides food and shelter for marine and terrestrial organisms. Tectonic and glacial influences have produced an extremely irregular coast characterized by long beaches and dune ridges backed by high marine terraces. Short meltwater streams and large river deltas add to the diversity of the coastal topography. The supratidal zone is important for marine mammal haulout areas and many terrestrial species. The intertidal and subtidal zones contain diverse communities of their own and are critically important for maintaining the food chain to both marine and terrestrial organisms.

The intertidal zone reaches from low to high tide and is intermittently inundated. Inhabitants of the intertidal zone include algae (e.g., *Fucus*), mussels, clams, barnacles, limpets, amphipods, isopods, marine worms, and certain fish species. The intertidal zone is used as a spawning and nursery area by many species of fish and as a feeding ground for a variety of marine organisms (e.g., sea otters, Dungeness crabs, juvenile shrimps, rockfish, cod, and juvenile fishes), terrestrial organisms (e.g., bears, river otters, and humans), and birds (e.g., black oystercatchers, harlequin ducks, numerous other species of ducks, and shorebirds).

The subtidal zone extends from the low tide boundary of the intertidal zone into the open water area. Because the near coastal subtidal community is similar in many respects to the intertidal community, it is considered separately from the marine ecosystem. Inhabitants of the shallow subtidal zone include amphipods, clams, eelgrass, crabs, juvenile cod, *Laminaria* plants, spot shrimp, and many other organisms.

c. Terrestrial Ecosystem

The landform and vegetation of the terrestrial ecosystem vary dramatically, but all are heavily influenced by a history of glaciation. Glaciers are still present at high elevations in all three regions. At lower elevations, ecological conditions vary between mountainous fjord and glacier-dissected rainforest areas and flat coastal deltas of the large rivers.

Terrestrial habitats can be classified into riparian, wetlands, old growth forest (200 yrs plus), mature forest (70-200 yrs), intermediate stage forest (40-70 yrs), early stage forest (0-20 yrs), lowland shrub, mud flats/gravel/rock, subalpine shrub, alpine shrub-lichen

tundra, cliffs, islands in lakes, and snow/ice/glaciers. Inland aquatic habitats include anadromous fish streams, anadromous fish lakes, resident fish streams, and resident fish lakes.

A wide range of bird and mammal species inhabit the terrestrial ecosystem of the oil spill area and many are more abundant there than anywhere else throughout their range. More than 200 species of birds occur in the oil spill area with more than 100 being shorebirds and seabirds. Approximately 100 species of these birds are year-round residents. Important nesting and breeding areas include the Copper River Delta, Kenai Peninsula, lower Cook Inlet, and the Kodiak and Afognak Island coasts. Moderate populations of bald eagle and peregrine falcon occur and the endangered Aleutian Canada goose and short-tailed albatross may be seasonal visitors to the area. The oil spill region contains 33 species of terrestrial mammals including brown and black bear, moose, Sitka blacktail deer, mink, and river otter. In addition to the five species of anadromous Pacific salmon (chinook, coho, pink, chum, and sockeye), many other fish contribute to the areas diverse inland aquatic communities including Dolly Varden char, rainbow and cutthroat trouts, lake trout, arctic grayling, whitefish, and turbot.

Of the 15 million acres within the oil spill area, 1.8 million are private lands. Most of these lands were converted from public to private ownership during the last 20 years as a result of the Alaska Native Claims Settlement Act. Lands chosen for conversion to private uses were primarily commercially valuable timber lands. Publicly owned lands include a diverse number of designations, both state and federal. The USForest Service manages Chugach National Forest predominantly for recreation and fish and wildlife. There have been no timber harvest on the forest since the mid to late 1970s, and no harvests are currently planned. The National Park Service administers the lands in the Kenai Fjords National Park, Katmai National Park and Preserve, and the Aniakchak National Monument and Preserve. Both the Kenai and Katmai Parks consist of large areas of federal designated wilderness or wilderness study areas. The western portion of the Chugach National Forest is also a wilderness study area. The Fish and Wildlife Service administers million of acres in the Kenai National Wildlife Refuge (NWR), Kodiak NWR, Alaska/Becharof NWR, and Alaska Maritime NWR.

needs change

Not true (Is true for pwS, but not for Kenai)

The spill area includes numerous State classifications including Katchemak Bay State Park, Shuyak State Park, and nineteen marine parks; the McNeil River State Game Refuge; and eight State Critical Habitat Areas: Cooper River Delta, Tugidak Island, Kachemak Bay, Fox River Flats, Anchor River and Fritz Creek, Clam Gulch, Kalgin Island, and Redoubt Bay.

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The draft Environmental Impact Statement and the Restoration Framework Document both contain specific life history information on the biological resources occurring in the spill area.

B. SOCIAL AND ECONOMIC ENVIRONMENT

This section describes the social, cultural, and economic conditions of the oil spill region.

1. Affected Communities

The communities most affected by the *Exxon Valdez* spill are grouped into four regions: the Kenai Peninsula Borough, the Kodiak Island Borough, the Lake and Peninsula Borough, and the Valdez–Cordova Census Area. The effects of the spill differ for each region and its communities. The more urban communities within these regions rely on commercial fishing, tourism, government and commercial offices, and agriculture. In contrast, the Native villages are largely dependent upon subsistence hunting and fishing.

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The portion of the Lake and Peninsula Borough within the spill area contains three communities, Chignik Bay, Chignik Lagoon, and Chignik Lake. Residents of all three

communities are ethnically mixed, Aleut, Russian, and Scandinavian. The economies of the communities are mixed cash-subsistence.

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The region has an abundant supply of fish, shellfish, and marine mammals. These and the other natural resources play an important part in the lives of area residents. In addition, the area is considered by many to be a unique, pristine wilderness, offering unparalleled opportunities for outdoor recreation, adventure, and travel.

2. Cultural and anthropological resources

Sites important to the Alaskan culture were injured by the oil spill and by the cleanup response, mainly by increasing human activity in and around the spill area. Some Alaska Native sites in the spill area are more than 11,000 years old. The sites within the oil spill area fall within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet. Cook Inlet was originally occupied by the Tanaina Athapaskans. Trade, warfare, ceremonial exchange, and occasional intermarriage led to a sharing of many cultural traits among the Pacific Eskimo, Tanaina, Aleut, Eskimo, Athapaskan, Eyak, and Tlingit Indian tribes.

3. Subsistence

The term "subsistence" refers to a particular pattern of harvesting and using naturally occurring renewable resources. In a subsistence system, land and labor are allocated in accordance with kinship, political, or tribal rights and obligations. Subsistence systems define a relationship with the earth and its resources, shape the economy, provide material sustenance, and form the basis of community life. Subsistence systems depend on natural resources in a way that Western industrialized societies do not. Alaska is the only State in which a significant proportion of the population lives off the land.

The economic aspects of the subsistence system also are dependent upon the availability of untainted natural resources. In a subsistence economy, food and other material resources are bartered, shared, and used to supplement supplies from other sources. Subsistence resources are the foundation of the mixed subsistence-cash economy in the subsistence villages in the spill area.

It should be noted that none of the rural communities in spill area is so isolated or so traditional as to be totally uninvolved in the modern market economy. Most spill area communities are characterized by a mixed subsistence-market economy. This label recognizes that a subsistence sector exists alongside a cash system, and that the socioeconomic system is viable because the sectors are complementary and mutually supportive. Even the most traditional subsistence hunter uses the most modern rifles,

snow machines, boats, boat motors, nets, and traps he can afford. These goods cannot be acquired without cash.

Communities which rely substantially on subsistence in the spill area are listed below:

Akhiok	Ivanof Bay	Ouzinkie
Chenega Bay	Karluk	Perryville
Chignik Lagoon	Larsen Bay	Port Graham
Chignik Lake	Nanwalek	Port Lions
Chignik	Old Harbor	Tatitlek

6. Commercial Fishing

Commercial fishing within the oil spill area is divided among three census regions: Southcentral, which includes PWS and the outer Kenai Peninsula area; Kodiak, which surrounds Kodiak and Afognak Islands; and Bristol Bay, which includes the area between Kodiak and the Alaskan Peninsula.

The fishing industry in the oil spill area is primarily a small-boat near shore fishery in contrast to the offshore highly capitalized fishery. The near shore fishery common in Prince William Sound, Cook Inlet, and Kodiak/Afognak Island area concentrates on seasonal salmon, herring, halibut, rockfish, black cod and to a lesser extent on Dungeness, king, and tanner (snow) crab. The offshore fishery located in the western Gulf of Alaska is found well offshore, concentrating on groundfish, king, and tanner crabs.

Table B-1. Fishing districts in within the oil spill area.

Region	Gear Type		
	Purse Seine and Beach Seine	Drift Gill Net	Set Net
Prince William Sound	Coghill, Unakwik, Northern, Eastern, Southeastern, Montague, and Southwestern	Coghill, Unakwik, Eshamy, and Copper River	Eshamy
Cook Inlet	Southern, Kamishak, Outer, Eastern, and Chitina Bay Subdistrict	Central	Southern (South side of Kamishak Bay and Port Graham Area), and Central
Kodiak	All districts	Northwest and Alitak	
Chignik	All districts		

7. Commercial Tourism

Tourism is Alaska's third-largest industry behind petroleum production and commercial fishing. Tourism was, and is, an industry of growing economic importance to the state.

Surveys have indicated that more than 750,000 people visited Alaska in 1989 from around the world and of this number 521,000 people visited in summer generating $304 million in summer revenue alone. The Southcentral region was the major beneficiary of visitor spending, capturing 44% of the $304 million.

8. Recreation

The oil spill area offers tremendous opportunities for outdoor recreation. Much of land in the oil spill area is in public ownership and is designated as parks, refuges, or forest lands. These areas provide developed and non-developed recreational opportunities including hunting, fishing, hiking, camping, skiing, sightseeing, backpacking, climbing, dogsledding, snowmobiling, snowshoeing, kayaking, canoeing, power boating, sailing, flightseeing, photographing, and filming to the residents and visitors of the region. These recreational opportunities have helped create the growing tourism industry in the region.

9. Sport Fishing and Hunting

Sport fishing and sport hunting constitute an important and distinct segment of the recreational activities in the oil spill region. Sport fishing is one of the most popular recreational activity for both residents and visitors of Alaska. Marine and freshwater systems provide a variety of sport fishing opportunities in the oil-spill region. Several species of Pacific salmon, rockfish, and halibut inhabit salt water. Species of Dolly Varden char, rainbow and cutthroat trout are found in freshwater streams and lakes. Although sport fishing is popular throughout the state, seventy percent of Alaska's sport fishing occurs in the Southcentral region, the majority of which occurs the Kenai Peninsula because access by car from Anchorage is relatively easy. The Kenai River is well known for king salmon fishing.

The oil spill areas have 12 species of big game, including several not found (Dall sheep), or very rare (wolf, wolverine, brown bear, caribou) in the other 49 states. Moose, caribou, Dall sheep, brown bears, black bears, wolves, mountain goats, black-tailed deer, and elk inhabit the oil spill area. Also abundant are many species of furbearers, ptarmigan, grouse, hare, waterfowl, migratory birds, raptors and marine mammals. Hunting is conducted according to the Alaska State Hunting and Trapping Regulations formulated by Alaska Department of Fish and Game, Board of Game Members. These regulations specify bag limits and season area-wise for hunting. The many wildlife refuges, parks, and national forests located within the oil-affected region provide tremendous opportunities for hunting.

The draft Environmental Impact Statement contains additional information on the cultural, social and economic resources occurring in the spill area.

Barbara

Appendix B: Affected Environment

This chapter describes the areas within the Gulf of Alaska from Prince William Sound to the Kodiak Archipelago, lower Cook Inlet, and the Alaska Peninsula directly affected by the oil spill. Part A covers the physical and biological environment including the physical setting, marine, coastal, and terrestrial ecosystems. Part B covers the social and economic environment in the affected area before and after the spill.

A. PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Physical Setting

The *Exxon Valdez* oil spill area is located in southcentral Alaska encompassing a surface area of approximately 75,000 square miles (125,000 km^2) and includes Prince William Sound, the lower Kenai Peninsula, Kodiak Island, Alaska Peninsula and lower Cook Inlet (see Figure __).

The geology of the region is young and relatively unstable; glaciers, earthquakes, and active volcanoes are common. The majority of the oil-spill area has a maritime climate with heavy precipitation, averaging 150 inches (381 cm) annually in Prince William Sound. Much of the area is snow covered in the winter, with up to 21 feet (6.4 m) of snowfall per year in Valdez. Temperatures in the region range from approximately 20° F (4° C) in January to a high of approximately 50° F (13° C) in the summer.

2. Greater Oil Spill Area Ecosystem

The oil-spill region contains a diverse system of marine, coastal, and terrestrial ecosystems that together constitute one of the largest and least developed regional ecosystems in the United States.

a. Marine Ecosystem

The marine ecosystem in the oil-spill area is characterized by deep water (hundreds of meters) and cold temperatures. High winds and strong currents provide mixing of waters and can produce 20 m waves. Total primary production in the region may be two to four times greater than in the open ocean. Phytoplankton (usually dominated by diatoms) and euphausiids, copepods, and other zooplankton are patchily distributed and are the major food source for many marine species, including whales and salmon. Polychaete annelids and mollusks dominate a diverse benthic community of more than 200 species to depths of 200 m. Soft corals also occur throughout the region.

Diverse and abundant communities of finfish and shellfish are present throughout the oil-spill area. Five species of Pacific salmon (chinook, coho, pink, chum, and sockeye) leave the open ocean to spawn in the intertidal zones and rivers of the region. Abundant saltwater finfish include halibut, sole, flounder, sablefish, pollock, mackerel, and Pacific ocean perch. King, tanner, and Dungeness crabs move to shallower water in summer

months for spawning. Shrimp, clams, and scallops are also important shellfish in the region.

Large populations of marine mammals are an important component of the marine ecosystem. The most abundant species are sea lions, harbor seals, sea otters, and whales. It is estimated that 100,000 marine mammals annually reside in or migrate through the Gulf of Alaska. Many areas within the oil-spill area contain unusually large concentrations of marine mammals, e.g., sea otters in Prince William Sound, sea lions on the Barren Islands, and seals throughout the bays and river deltas of the mainland and Kodiak Island.

b. Coastal Ecosystem

The coastal ecosystem is vital to the health of the greater oil-spill area ecosystem. It connects the highly productive marine ecosystem to the rugged terrestrial ecosystem and provides food and shelter for marine and terrestrial organisms. Tectonic and glacial influences have produced an extremely irregular coast characterized by long beaches and dune ridges backed by high marine terraces. Short meltwater streams and large river deltas add to the diversity of the coastal topography. The supratidal zone is important for marine mammal haulout areas and many terrestrial species. The intertidal and subtidal zones contain diverse communities of their own and are critically important for maintaining the food chain to both marine and terrestrial organisms.

The intertidal zone reaches from low to high tide and is intermittently inundated. Inhabitants of the intertidal zone include algae (e.g., *Fucus*), mussels, clams, barnacles, limpets, amphipods, isopods, marine worms, and certain fish species. The intertidal zone is used as a spawning and nursery area by many species of fish and as a feeding ground for a variety of marine organisms (e.g., sea otters, Dungeness crabs, juvenile shrimps, rockfish, cod, and juvenile fishes), terrestrial organisms (e.g., bears, river otters, and humans), and birds (e.g., black oystercatchers, harlequin ducks, numerous other species of ducks, and shorebirds).

The subtidal zone extends from the low tide boundary of the intertidal zone into the open water area. Because the near coastal subtidal community is similar in many respects to the intertidal community, it is considered separately from the marine ecosystem. Inhabitants of the shallow subtidal zone include amphipods, clams, eelgrass, crabs, juvenile cod, *Laminaria* plants, spot shrimp, and many other organisms.

c. Terrestrial Ecosystem

The landform and vegetation of the terrestrial ecosystem vary dramatically, but all are heavily influenced by a history of glaciation. Glaciers are still present at high elevations in all three regions. At lower elevations, ecological conditions vary between mountainous fjord and glacier-dissected rainforest areas and flat coastal deltas of the large rivers.

Terrestrial habitats can be classified into riparian, wetlands, old growth forest (200 yrs+ plus), mature forest (70-200 yrs), intermediate stage forest (40-70 yrs), early stage forest (0-20 yrs), lowland shrub, mud flats/gravel/rock, subalpine shrub, alpine shrub-lichen

tundra, cliffs, islands in lakes, and snow/ice/glaciers. Inland aquatic habitats include anadromous fish streams, anadromous fish lakes, resident fish streams, and resident fish lakes.

A wide range of bird and mammal species inhabit the terrestrial ecosystem of the oil-spill area and many are more abundant there than anywhere else throughout their range. More than 200 species of birds occur in the oil-spill area with more than 100 being shorebirds and seabirds. Approximately 100 species of these birds are year-round residents. Important nesting and breeding areas include the Copper River Delta, Kenai Peninsula, lower Cook Inlet, and the Kodiak and Afognak Island coasts. Moderate populations of bald eagle and peregrine falcon occur and the endangered Aleutian Canada goose and short-tailed albatross may be seasonal visitors to the area. The oil-spill region contains 33 species of terrestrial mammals including brown and black bear, moose, Sitka blacktail deer, mink, and river otter. In addition to the five species of anadromous Pacific salmon (chinook, coho, pink, chum, and sockeye), many other fish contribute to the areas diverse inland aquatic communities including Dolly Varden char, rainbow and cutthroat trouts, lake trout, arctic grayling, whitefish, and turbot.

Of the 15 million acres within the oil-spill area, 1.8 million are private lands. Most of these lands were converted from public to private ownership during the last 20 years as a result of the Alaska Native Claims Settlement Act. Lands chosen for conversion to private uses were primarily commercially-valuable timber lands. Publicly owned lands include a diverse number of designations, both state and federal. The US Forest Service manages Chugach National Forest predominantly for recreation and fish and wildlife. There have been no timber harvest on the forest since the mid to late 1970s, and no harvests are currently planned. The National Park Service administers the lands in the Kenai Fjords National Park, Katmai National Park and Preserve, and the Aniakchak National Monument and Preserve. Both the Kenai and Katmai Parks consist of large areas of federal-designated wilderness or wilderness study areas. The western portion of the Chugach National Forest is also a wilderness study area. The Fish and Wildlife Service administers million of acres in the Kenai National Wildlife Refuge (NWR), Kodiak NWR, Alaska/Becharof NWR, and Alaska Maritime NWR.

The spill area includes numerous State classifications including Katchemak (Kachemak) Bay State Park, Shuyak State Park, and nineteen marine parks; the McNeil River State Game Refuge; and eight State Critical Habitat Areas: Cooper River Delta, Tugidak Island, Kachemak Bay, Fox River Flats, Anchor River and Fritz Creek, Clam Gulch, Kalgin Island, and Redoubt Bay.

All of these areas are afforded some degree of protection from land uses that could adversely affect or slow the recovery of injured resources and services. Wilderness areas in particular provide strict protection against future degradation of the ecosystem.

Land management activities, such as those that involve timber harvesting (either clear-cut logging or selective cutting), have important consequences for the recovery of injured resources in the oil-spill area. Although timber harvesting is allowed on some federal and State lands, it is the primary activity planned for the some of forested private lands.

The populations of some species, such as marbled murrelets, pigeon guillemots, and harbor seals, were declining before the spill. Their rate of decline was accelerated by the spill, but other factors such as variations in climatic conditions, habitat loss, or increased competition for food may also have influenced long-term trends in their health and populations. Still other species may have been indirectly affected by changes in food supplies or disruption of their habitats.

The availability of population and habitat data varies from species to species. Federal and State environmental agencies had conducted baseline surveys of some native species prior to the oil spill, documenting selected species' populations and critical habitats. Some species have never been inventoried, while others, such as the brown bear and the bald eagle, are counted regularly for management purposes. Much is known about species that have played a significant historic or economic role in the region, such as salmon.

The draft Environmental Impact Statement and the Restoration Framework Document both contain specific life history information on the biological resources occurring in the spill area.

B. SOCIAL AND ECONOMIC ENVIRONMENT

This section describes the social, cultural, and economic conditions of the oil spill region.

1. Affected Communities

The communities most affected by the *Exxon Valdez* spill are grouped into four regions: the Kenai Peninsula Borough, the Kodiak Island Borough, the Lake and Peninsula Borough, and the Valdez–Cordova Census Area. The effects of the spill differ for each region and its communities. The more urban communities within these regions rely on commercial fishing, tourism, government and commercial offices, and agriculture. In contrast, the Native villages are largely dependent upon subsistence hunting and fishing.

The Kenai Peninsula Borough, which is located south of Anchorage, includes both sides of Cook Inlet from the southern tip of the Kenai Peninsula north to the Knik Arm–Turnagain Arm split. The Kenai Peninsula holds 99 percent of the borough's population and most of the area's development because it is linked by roads to Anchorage. Sixty-three percent of the borough's population (27,338 people) lives in Kenai and Soldotna. The southern Kenai Peninsula contains the cities of Homer and Seldovia and the Native villages of Port Graham and Nanwalek.

The Kodiak Island region includes the city of Kodiak and the six Native villages of Port Lions, Ouzinkie, Larsen Bay, Karluk, Old Harbor, and Akhiok. These communities are part of the Kodiak Island Borough. The borough population is between 13,000 and 15,000 and includes Natives of Aleutic background and immigrants from the Philippines and from Central America.

The portion of the Lake and Peninsula Borough within the spill area contains three communities, Chignik Bay, Chignik Lagoon, and Chignik Lake. Residents of all three

communities are ethnically mixed, Aleut, Russian, and Scandinavian. The economies of the communities are mixed cash-subsistence.

The Prince William Sound region covers an area of about 20,000 square miles of water, ice, and land. Within the oil-spill area are included five communities: Valdez, Cordova, Whittier, Chenega Bay, and Tatitlek. Each is accessible by air or water, and all have dock or harbor facilities. Only Valdez is accessible by road.

The region has an abundant supply of fish, shellfish, and marine mammals. These and the other natural resources play an important part in the lives of area residents. In addition, the area is considered by many to be a unique, pristine wilderness, offering unparalleled opportunities for outdoor recreation, adventure, and travel.

2. Cultural and anthropological resources

Sites important to the Alaskan culture were injured by the oil spill and by the cleanup response, mainly by increasing human activity in and around the spill area. Some Alaska Native sites in the spill area are more than 11,000 years old. The sites within the oil-spill area fall within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet. Cook Inlet was originally occupied by the Tanaina Athapaskans. Trade, warfare, ceremonial exchange, and occasional intermarriage led to a sharing of many cultural traits among the Pacific Eskimo, Tanaina, Aleut, Eskimo, Athapaskan, Eyak, and Tlingit Indian tribes.

3. Subsistence

The term "subsistence" refers to a particular pattern of harvesting and using naturally occurring renewable resources. In a subsistence system, land and labor are allocated in accordance with kinship, political, or tribal rights and obligations. Subsistence systems define a relationship with the earth and its resources, shape the economy, provide material sustenance, and form the basis of community life. Subsistence systems depend on natural resources in a way that Western industrialized societies do not. Alaska is the only State in which a significant proportion of the population lives off the land.

The economic aspects of the subsistence system also are dependent upon the availability of untainted natural resources. In a subsistence economy, food and other material resources are bartered, shared, and used to supplement supplies from other sources. Subsistence resources are the foundation of the mixed subsistence-cash economy in the subsistence villages in the spill area.

It should be noted that none of the rural communities in spill area is so isolated or so traditional as to be totally uninvolved in the modern market economy. Most spill area communities are characterized by a mixed subsistence-market economy. This label recognizes that a subsistence sector exists alongside a cash system, and that the socioeconomic system is viable because the sectors are complementary and mutually supportive. Even the most traditional subsistence hunter uses the most modern rifles,

snow machines, boats, boat motors, nets, and traps he can afford. These goods cannot be acquired without cash.

Communities which rely substantially on subsistence in the spill area are listed below:

Akhiok	Ivanof Bay	Ouzinkie
Chenega Bay	Karluk	Perryville
Chignik Lagoon	Larsen Bay	Port Graham
Chignik Lake	Nanwalek	Port Lions
Chignik Bay	Old Harbor	Tatitlek

6. Commercial Fishing

Commercial fishing within the oil spill area is divided among three census regions: Southcentral, which includes PWS and the outer Kenai Peninsula area; Kodiak, which surrounds Kodiak and Afognak Islands; and Bristol Bay, which includes the area between Kodiak and the Alaskan Peninsula.

The fishing industry in the oil spill area is primarily a small-boat near shore fishery in contrast to the offshore highly capitalized fishery. The near shore fishery common in Prince William Sound, Cook Inlet, and Kodiak/Afognak Island area concentrates on seasonal salmon, herring, halibut, rockfish, black cod and to a lesser extent on Dungeness, king, and tanner (snow) crab. The offshore fishery located in the western Gulf of Alaska is found well offshore, concentrating on groundfish, king and tanner crabs.

Set

Table B-1. Fishing districts in within the oil spill area.

Region	Gear Type		
	Purse Seine and Beach Seine	Drift Gill Net	Set Net
Prince William Sound	Coghill, Unakwik, Northern, Eastern, Southeastern, Montague, and Southwestern	Coghill, Unakwik, Eshamy, and Copper River	Eshamy
Cook Inlet	Southern, Kamishak, Outer, Eastern, and Chitina Bay Subdistrict	Central	Southern (South side of Kamishak Bay and Port Graham Area), and Central
Kodiak	All districts	Northwest and Alitak	
Chignik	All districts		

7. Commercial Tourism

Tourism is Alaska's third-largest industry behind petroleum production and commercial fishing. Tourism was, and is, an industry of growing economic importance to the state.

Surveys have indicated that more than 750,000 people visited Alaska in 1989 from around the world and of this number 521,000 people visited in summer generating $304 million in summer revenue alone. The Southcentral region was the major beneficiary of visitor spending, capturing 44% of the $304 million.

8. Recreation

The oil-spill area offers tremendous opportunities for outdoor recreation. Much of land in the oil-spill area is in public ownership and is designated as parks, refuges, or forest lands. These areas provide developed and non-developed recreational opportunities including hunting, fishing, hiking, camping, skiing, sightseeing, backpacking, climbing, dogsledding, snowmobiling, snowshoeing, kayaking, canoeing, power boating, sailing, flightseeing, photographing, and filming to the residents and visitors of the region. These recreational opportunities have helped create the growing tourism industry in the region.

9. Sport Fishing and Hunting

Sport fishing and sport hunting constitute an important and distinct segment of the recreational activities in the oil-spill region. Sport fishing is one of the most popular recreational activity for both residents and visitors of Alaska. Marine and freshwater systems provide a variety of sport fishing opportunities in the oil-spill region. Several species of Pacific salmon, rockfish, and halibut inhabit salt water. Species of Dolly Varden char, rainbow and cutthroat trout are found in freshwater streams and lakes. Although sport fishing is popular throughout the state, seventy percent of Alaska's sport fishing occurs in the Southcentral region, the majority of which occurs the Kenai Peninsula because access by car from Anchorage is relatively easy. The Kenai River is well known for king salmon fishing.

The oil-spill areas have 12 species of big game, including several not found (Dall sheep), or very rare (wolf, wolverine, brown bear, caribou) in the other 49 states. Moose, caribou, Dall sheep, brown bears, black bears, wolves, mountain goats, black-tailed deer, and elk inhabit the oil-spill area. Also abundant are many species of furbearers, ptarmigan, grouse, hare, waterfowl, migratory birds, raptors and marine mammals. Hunting is conducted according to the Alaska State Hunting and Trapping Regulations formulated by Alaska Department of Fish and Game, Board of Game Members. These regulations specify bag limits and season area-wise for hunting. The many wildlife refuges, parks, and national forests located within the oil-affected region provide tremendous opportunities for hunting.

The draft Environmental Impact Statement contains additional information on the cultural, social and economic resources occurring in the spill area.

Appendix B: Affected Environment

This chapter describes the areas within the Gulf of Alaska from Prince William Sound to the Kodiak Archipelago, lower Cook Inlet, and the Alaska Peninsula directly affected by the oil spill. Part A covers the physical and biological environment including the physical setting, marine, coastal, and terrestrial ecosystems. Part B covers the social and economic environment in the affected area before and after the spill.

A. PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Physical Setting

The *Exxon Valdez* oil spill area is located in southcentral Alaska encompassing a surface area of approximately 75,000 square miles (125,000 km^2) and includes Prince William Sound, the lower Kenai Peninsula, Kodiak Island, Alaska Peninsula and lower Cook Inlet (see Figure __).

The geology of the region is young and relatively unstable; glaciers, earthquakes, and active volcanoes are common. The majority of the oil spill area has a maritime climate with heavy precipitation, averaging 150 inches (381 cm) annually in Prince William Sound. Much of the area is snow covered in the winter, with up to 21 feet (6.4 m) of snowfall per year in Valdez. Temperatures in the region range from approximately 20° F (4° C) in January to a high of approximately 50° F (13° C) in the summer.

2. Greater Oil Spill Area Ecosystem

The oil spill region contains a diverse system of marine, coastal, and terrestrial ecosystems that together constitute one of the largest and least developed regional ecosystems in the United States.

a. Marine Ecosystem

The marine ecosystem in the oil spill area is characterized by deep water (hundreds of meters) and cold temperatures. High winds and strong currents provide mixing of waters and can produce 20 m waves. Total primary production in the region may be two to four times greater than in the open ocean. Phytoplankton (usually dominated by diatoms) and euphausiids, copepods, and other zooplankton are patchily distributed and are the major food source for many marine species, including whales and salmon. Polychaete annelids and mollusks dominate a diverse benthic community of more than 200 species to depths of 200 m. Soft corals also occur throughout the region.

Diverse and abundant communities of finfish and shellfish are present throughout the oil spill area. Five species of Pacific salmon (chinook, coho, pink, chum, and sockeye) leave the open ocean to spawn in the intertidal zones and rivers of the region. Abundant saltwater finfish include halibut, sole, flounder, sablefish, pollock, mackerel, and Pacific ocean perch. King, tanner, and Dungeness crabs move to shallower water in summer

months for spawning. Shrimp, clams, and scallops are also important shellfish in the region.

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b. Coastal Ecosystem

The coastal ecosystem is vital to the health of the greater oil spill area ecosystem. It connects the highly productive marine ecosystem to the rugged terrestrial ecosystem and provides food and shelter for marine and terrestrial organisms. Tectonic and glacial influences have produced an extremely irregular coast characterized by long beaches and dune ridges backed by high marine terraces. Short meltwater streams and large river deltas add to the diversity of the coastal topography. The supratidal zone is important for marine mammal haulout areas and many terrestrial species. The intertidal and subtidal zones contain diverse communities of their own and are critically important for maintaining the food chain to both marine and terrestrial organisms.

The intertidal zone reaches from low to high tide and is intermittently inundated. Inhabitants of the intertidal zone include algae (e.g., *Fucus*), mussels, clams, barnacles, limpets, amphipods, isopods, marine worms, and certain fish species. The intertidal zone is used as a spawning and nursery area by many species of fish and as a feeding ground for a variety of marine organisms (e.g., sea otters, Dungeness crabs, juvenile shrimps, rockfish, cod, and juvenile fishes), terrestrial organisms (e.g., bears, river otters, and humans), and birds (e.g., black oystercatchers, harlequin ducks, numerous other species of ducks, and shorebirds).

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The landform and vegetation of the terrestrial ecosystem vary dramatically, but all are heavily influenced by a history of glaciation. Glaciers are still present at high elevations in all three regions. At lower elevations, ecological conditions vary between mountainous fjord and glacier-dissected rainforest areas and flat coastal deltas of the large rivers.

Terrestrial habitats can be classified into riparian, wetlands, old growth forest (200 yrs plus), mature forest (70-200 yrs), intermediate stage forest (40-70 yrs), early stage forest (0-20 yrs), lowland shrub, mud flats/gravel/rock, subalpine shrub, alpine shrub-lichen

tundra, cliffs, islands in lakes, and snow/ice/glaciers. Inland aquatic habitats include anadromous fish streams, anadromous fish lakes, resident fish streams, and resident fish lakes.

A wide range of bird and mammal species inhabit the terrestrial ecosystem of the oil spill area and many are more abundant there than anywhere else throughout their range. More than 200 species of birds occur in the oil spill area with more than 100 being shorebirds and seabirds. Approximately 100 species of these birds are year-round residents. Important nesting and breeding areas include the Copper River Delta, Kenai Peninsula, lower Cook Inlet, and the Kodiak and Afognak Island coasts. Moderate populations of bald eagle and peregrine falcon occur and the endangered Aleutian Canada goose and short-tailed albatross may be seasonal visitors to the area. The oil spill region contains 33 species of terrestrial mammals including brown and black bear, moose, Sitka blacktail deer, mink, and river otter. In addition to the five species of anadromous Pacific salmon (chinook, coho, pink, chum, and sockeye), many other fish contribute to the areas diverse inland aquatic communities including Dolly Varden char, rainbow and cutthroat trouts, lake trout, arctic grayling, whitefish, and turbot.

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? 2 marine Parks Driftwood Bay + Horseshoe Bay

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762-2606 what was Redoubt Bay

All of these areas are afforded some degree of protection from land uses that could adversely affect or slow the recovery of injured resources and services. Wilderness areas in particular provide strict protection against future degradation of the ecosystem.

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B. SOCIAL AND ECONOMIC ENVIRONMENT

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The communities most affected by the *Exxon Valdez* spill are grouped into four regions: the Kenai Peninsula Borough, the Kodiak Island Borough, the Lake and Peninsula Borough, and the Valdez–Cordova Census Area. The effects of the spill differ for each region and its communities. The more urban communities within these regions rely on commercial fishing, tourism, government and commercial offices, and agriculture. In contrast, the Native villages are largely dependent upon subsistence hunting and fishing.

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communities are ethnically mixed, Aleut, Russian, and Scandinavian. The economies of the communities are mixed cash-subsistence.

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2. Cultural and anthropological resources

Sites important to the Alaskan culture were injured by the oil spill and by the cleanup response, mainly by increasing human activity in and around the spill area. Some Alaska Native sites in the spill area are more than 11,000 years old. The sites within the oil spill area fall within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet. Cook Inlet was originally occupied by the Tanaina Athapaskans. Trade, warfare, ceremonial exchange, and occasional intermarriage led to a sharing of many cultural traits among the Pacific Eskimo, Tanaina, Aleut, Eskimo, Athapaskan, Eyak, and Tlingit Indian tribes.

3. Subsistence

The term "subsistence" refers to a particular pattern of harvesting and using naturally occurring renewable resources. In a subsistence system, land and labor are allocated in accordance with kinship, political, or tribal rights and obligations. Subsistence systems define a relationship with the earth and its resources, shape the economy, provide material sustenance, and form the basis of community life. Subsistence systems depend on natural resources in a way that Western industrialized societies do not. Alaska is the only State in which a significant proportion of the population lives off the land.

The economic aspects of the subsistence system also are dependent upon the availability of untainted natural resources. In a subsistence economy, food and other material resources are bartered, shared, and used to supplement supplies from other sources. Subsistence resources are the foundation of the mixed subsistence-cash economy in the subsistence villages in the spill area.

It should be noted that none of the rural communities in spill area is so isolated or so traditional as to be totally uninvolved in the modern market economy. Most spill area communities are characterized by a mixed subsistence-market economy. This label recognizes that a subsistence sector exists alongside a cash system, and that the socioeconomic system is viable because the sectors are complementary and mutually supportive. Even the most traditional subsistence hunter uses the most modern rifles,

snow machines, boats, boat motors, nets, and traps he can afford. These goods cannot be acquired without cash.

Communities which rely substantially on subsistence in the spill area are listed below:

Akhiok	Ivanof Bay	Ouzinkie
Chenega Bay	Karluk	Perryville
Chignik Lagoon	Larsen Bay	Port Graham
Chignik Lake	Nanwalek	Port Lions
Chignik	Old Harbor	Tatitlek

6. Commercial Fishing

Commercial fishing within the oil spill area is divided among three census regions: Southcentral, which includes PWS and the outer Kenai Peninsula area; Kodiak, which surrounds Kodiak and Afognak Islands; and Bristol Bay, which includes the area between Kodiak and the Alaskan Peninsula.

The fishing industry in the oil spill area is primarily a small-boat near shore fishery in contrast to the offshore highly capitalized fishery. The near shore fishery common in Prince William Sound, Cook Inlet, and Kodiak/Afognak Island area concentrates on seasonal salmon, herring, halibut, rockfish, black cod and to a lesser extent on Dungeness, king, and tanner (snow) crab. The offshore fishery located in the western Gulf of Alaska is found well offshore, concentrating on groundfish, king, and tanner crabs.

Table B-1. Fishing districts in within the oil spill area.

Region	Gear Type		
	Purse Seine and Beach Seine	Drift Gill Net	Set Net
Prince William Sound	Coghill, Unakwik, Northern, Eastern, Southeastern, Montague, and Southwestern	Coghill, Unakwik, Eshamy, and Copper River	Eshamy
Cook Inlet	Southern, Kamishak, Outer, Eastern, and Chitina Bay Subdistrict	Central	Southern (South side of Kamishak Bay and Port Graham Area), and Central
Kodiak	All districts	Northwest and Alitak	
Chignik	All districts		

7. Commercial Tourism

Tourism is Alaska's third-largest industry behind petroleum production and commercial fishing. Tourism was, and is, an industry of growing economic importance to the state.

Surveys have indicated that more than 750,000 people visited Alaska in 1989 from around the world and of this number 521,000 people visited in summer generating $304 million in summer revenue alone. The Southcentral region was the major beneficiary of visitor spending, capturing 44% of the $304 million.

8. Recreation

The oil spill area offers tremendous opportunities for outdoor recreation. Much of land in the oil spill area is in public ownership and is designated as parks, refuges, or forest lands. These areas provide developed and non-developed recreational opportunities including hunting, fishing, hiking, camping, skiing, sightseeing, backpacking, climbing, dogsledding, snowmobiling, snowshoeing, kayaking, canoeing, power boating, sailing, flightseeing, photographing, and filming to the residents and visitors of the region. These recreational opportunities have helped create the growing tourism industry in the region.

9. Sport Fishing and Hunting

Sport fishing and sport hunting constitute an important and distinct segment of the recreational activities in the oil spill region. Sport fishing is one of the most popular recreational activity for both residents and visitors of Alaska. Marine and freshwater systems provide a variety of sport fishing opportunities in the oil-spill region. Several species of Pacific salmon, rockfish, and halibut inhabit salt water. Species of Dolly Varden char, rainbow and cutthroat trout are found in freshwater streams and lakes. Although sport fishing is popular throughout the state, seventy percent of Alaska's sport fishing occurs in the Southcentral region, the majority of which occurs the Kenai Peninsula because access by car from Anchorage is relatively easy. The Kenai River is well known for king salmon fishing.

The oil spill areas have 12 species of big game, including several not found (Dall sheep), or very rare (wolf, wolverine, brown bear, caribou) in the other 49 states. Moose, caribou, Dall sheep, brown bears, black bears, wolves, mountain goats, black-tailed deer, and elk inhabit the oil spill area. Also abundant are many species of furbearers, ptarmigan, grouse, hare, waterfowl, migratory birds, raptors and marine mammals. Hunting is conducted according to the Alaska State Hunting and Trapping Regulations formulated by Alaska Department of Fish and Game, Board of Game Members. These regulations specify bag limits and season area-wise for hunting. The many wildlife refuges, parks, and national forests located within the oil-affected region provide tremendous opportunities for hunting.

The draft Environmental Impact Statement contains additional information on the cultural, social and economic resources occurring in the spill area.

Appendix B: Affected Environment

This chapter describes the areas within the Gulf of Alaska from Prince William Sound to the Kodiak Archipelago, lower Cook Inlet, and the Alaska Peninsula directly affected by the oil spill. Part A covers the physical and biological environment including the physical setting, marine, coastal, and terrestrial ecosystems. Part B covers the social and economic environment in the affected area before and after the spill.

A. PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Physical Setting

The *Exxon Valdez* oil spill area is located in southcentral Alaska encompassing a surface area of approximately 75,000 square miles (125,000 km^2) and includes Prince William Sound, the lower Kenai Peninsula, Kodiak Island, Alaska Peninsula and lower Cook Inlet (see Figure __).

The geology of the region is young and relatively unstable; glaciers, earthquakes, and active volcanoes are common. The majority of the oil spill area has a maritime climate with heavy precipitation, averaging 150 inches (381 cm) annually in Prince William Sound. Much of the area is snow-covered in the winter, with up to 21 feet (6.4 m) of snowfall per year in Valdez. Temperatures in the region range from approximately 20° F (4° C) in January to a high of approximately 50° F (13° C) in the summer.

2. Greater Oil Spill Area Ecosystem

The oil spill region contains a diverse system of marine, coastal, and terrestrial ecosystems that together constitute one of the largest and least developed regional ecosystems in the United States.

a. Marine Ecosystem

The marine ecosystem in the oil spill area is characterized by deep water (hundreds of meters) and cold temperatures. High winds and strong currents provide mixing of waters and can produce 20 m waves. Total primary production in the region may be two to four times greater than in the open ocean. Phytoplankton (usually dominated by diatoms), and euphausiids, copepods, and other zooplankton are patchily distributed and are the major food source for many marine species, including whales and salmon. Polychaete annelids and mollusks dominate a diverse benthic community of more than 200 species to depths of 200 m. Soft corals also occur throughout the region.

Diverse and abundant communities of finfish and shellfish are present throughout the oil spill area. Five species of Pacific salmon (chinook, coho, pink, chum, and sockeye) leave the open ocean to spawn in the intertidal zones and rivers of the region. Abundant saltwater finfish include halibut, sole, flounder, sablefish, pollock, mackerel, and Pacific ocean perch. King, tanner, and Dungeness crabs move to shallower water in summer

months for spawning. Shrimp, clams, and scallops are also important shellfish in the region.

Large populations of marine mammals are an important component of the marine ecosystem. The most abundant species are sea lions, harbor seals, sea otters, and whales. It is estimated that 100,000 marine mammals annually reside in or migrate through the Gulf of Alaska. Many areas within the oil spill area contain unusually large concentrations of marine mammals, e.g., sea otters in Prince William Sound, sea lions on the Barren Islands, and seals throughout the bays and river deltas of the mainland and Kodiak Island.

b. Coastal Ecosystem

The coastal ecosystem is vital to the health of the greater oil spill area ecosystem. It connects the highly productive marine ecosystem to the rugged terrestrial ecosystem and provides food and shelter for marine and terrestrial organisms. Tectonic and glacial influences have produced an extremely irregular coast characterized by long beaches and dune ridges backed by high marine terraces. Short meltwater streams and large river deltas add to the diversity of the coastal topography. The supratidal zone is important for marine mammal haulout areas and many terrestrial species. The intertidal and subtidal zones contain diverse communities of their own and are critically important for maintaining the food chain to both marine and terrestrial organisms.

The intertidal zone reaches from low to high tide and is intermittently inundated. Inhabitants of the intertidal zone include algae (e.g., *Fucus*), mussels, clams, barnacles, limpets, amphipods, isopods, marine worms, and certain fish species. The intertidal zone is used as a spawning and nursery area by many species of fish and as a feeding ground for a variety of marine organisms (e.g., sea otters, Dungeness crabs, juvenile shrimps, rockfish, cod, and juvenile fishes), terrestrial organisms (e.g., bears, river otters, and humans), and birds (e.g., black oystercatchers, harlequin ducks, numerous other species of ducks, and shorebirds).

The subtidal zone extends from the low tide boundary of the intertidal zone into the open water area. Because the near coastal subtidal community is similar in many respects to the intertidal community, it is considered separately from the marine ecosystem. Inhabitants of the shallow subtidal zone include amphipods, clams, eelgrass, crabs, juvenile cod, *Laminaria* plants, spot shrimp, and many other organisms.

c. Terrestrial Ecosystem

The landform and vegetation of the terrestrial ecosystem vary dramatically, but all are heavily influenced by a history of glaciation. Glaciers are still present at high elevations in all three regions. At lower elevations, ecological conditions vary between mountainous fjord and glacier-dissected rainforest areas and flat coastal deltas of the large rivers.

Terrestrial habitats can be classified into riparian, wetlands, old growth forest (200 yrs plus), mature forest (70-200 yrs), intermediate stage forest (40-70 yrs), early stage forest (0-20 yrs), lowland shrub, mud flats/gravel/rock, subalpine shrub, alpine shrub-lichen

tundra, cliffs, islands in lakes, and snow/ice/glaciers. Inland aquatic habitats include anadromous fish streams, anadromous fish lakes, resident fish streams, and resident fish lakes.

A wide range of bird and mammal species inhabit the terrestrial ecosystem of the oil spill area and many are more abundant there than anywhere else throughout their range. More than 200 species of birds occur in the oil spill area with more than 100 being shorebirds and seabirds. Approximately 100 species of these birds are year-round residents. Important nesting and breeding areas include the Copper River Delta, Kenai Peninsula, lower Cook Inlet, and the Kodiak and Afognak Island coasts. Moderate populations of bald eagle and peregrine falcon occur and the endangered Aleutian Canada goose and short-tailed albatross may be seasonal visitors to the area. The oil spill region contains 33 species of terrestrial mammals including brown and black bear, moose, Sitka blacktail deer, mink, and river otter. In addition to the five species of anadromous Pacific salmon (chinook, coho, pink, chum, and sockeye), many other fish contribute to the areas diverse inland aquatic communities including Dolly Varden char, rainbow and cutthroat trouts, lake trout, arctic grayling, whitefish, and turbot.

Of the 15 million acres within the oil spill area, 1.8 million are private lands. Most of these lands were converted from public to private ownership during the last 20 years as a result of the Alaska Native Claims Settlement Act. Lands chosen for conversion to private uses were primarily commercially valuable timber lands. Publicly-owned lands include a diverse number of designations, both state and federal. The USForest Service manages Chugach National Forest predominantly for recreation and fish and wildlife. There have been no timber harvest on the forest since the mid to late 1970s, and no harvests are currently planned. The National Park Service administers the lands in the Kenai Fjords National Park, Katmai National Park and Preserve, and the Aniakchak National Monument and Preserve. Both the Kenai and Katmai Parks consist of large areas of federal designated wilderness or wilderness study areas. The western portion of the Chugach National Forest is also a wilderness study area. The Fish and Wildlife Service administers million of acres in the Kenai National Wildlife Refuge (NWR), Kodiak NWR, Alaska/Becharof NWR, and Alaska Maritime NWR.

The spill area includes numerous State classifications including Katchemak Bay State Park, Shuyak State Park, and nineteen marine parks; the McNeil River State Game Refuge; and eight State Critical Habitat Areas: Cooper River Delta, Tugidak Island, Kachemak Bay, Fox River Flats, Anchor River and Fritz Creek, Clam Gulch, Kalgin Island, and Redoubt Bay.

All of these areas are afforded some degree of protection from land uses that could adversely affect or slow the recovery of injured resources and services. Wilderness areas in particular provide strict protection against future degradation of the ecosystem.

Land management activities, such as those that involve timber harvesting (either clear-cut logging or selective cutting), have important consequences for the recovery of injured resources in the oil spill area. Although timber harvesting is allowed on some Federal and State lands, it is the primary activity planned for the some of forested private lands.

The populations of some species, such as marbled murrelets, pigeon guillemots, and harbor seals, were declining before the spill. Their rate of decline was accelerated by the spill, but other factors such as variations in climatic conditions, habitat loss, or increased competition for food may also have influenced long-term trends in their health and populations. Still other species may have been indirectly affected by changes in food supplies or disruption of their habitats.

The availability of population and habitat data varies from species to species. Federal and State environmental agencies had conducted baseline surveys of some native species prior to the oil spill, documenting selected species' populations and critical habitats. Some species have never been inventoried, while others, such as the brown bear and the bald eagle, are counted regularly for management purposes. Much is known about species that have played a significant historic or economic role in the region, such as salmon.

The draft Environmental Impact Statement and the Restoration Framework Document both contain specific life history information on the biological resources occurring in the spill area.

B. SOCIAL AND ECONOMIC ENVIRONMENT

This section describes the social, cultural, and economic conditions of the oil spill region.

1. Affected Communities

The communities most affected by the *Exxon Valdez* spill are grouped into four regions: the Kenai Peninsula Borough, the Kodiak Island Borough, the Lake and Peninsula Borough, and the Valdez–Cordova Census Area. The effects of the spill differ for each region and its communities. The more urban communities within these regions rely on commercial fishing, tourism, government and commercial offices, and agriculture. In contrast, the Native villages are largely dependent upon subsistence hunting and fishing.

The Kenai Peninsula Borough, which is located south of Anchorage, includes both sides of Cook Inlet from the southern tip of the Kenai Peninsula north to the Knik Arm–Turnagain Arm split. The Kenai Peninsula holds 99 percent of the borough's population and most of the area's development because it is linked by roads to Anchorage. Sixty-three percent of the borough's population (27,338 people) lives in Kenai and Soldotna. The southern Kenai Peninsula contains the cities of Homer and Seldovia and the Native villages of Port Graham and Nanwalek.

The Kodiak Island region includes the city of Kodiak and the six Native villages of Port Lions, Ouzinkie, Larsen Bay, Karluk, Old Harbor, and Akhiok. These communities are part of the Kodiak Island Borough. The borough population is between 13,000 and 15,000 and includes Natives of Aleutic background and immigrants from the Philippines and from Central America.

The portion of the Lake and Peninsula Borough within the spill area contains three communities, Chignik Bay, Chignik Lagoon, and Chignik Lake. Residents of all three

communities are ethnically mixed, Aleut, Russian, and Scandinavian. The economies of the communities are mixed cash-subsistence.

The Prince William Sound region covers an area of about 20,000 square miles of water, ice, and land. Within the oil spill area are included five communities: Valdez, Cordova, Whittier, Chenega Bay, and Tatitlek. Each is accessible by air or water, and all have dock or harbor facilities. Only Valdez is accessible by road.

The region has an abundant supply of fish, shellfish, and marine mammals. These and the other natural resources play an important part in the lives of area residents. In addition, the area is considered by many to be a unique, pristine wilderness, offering unparalleled opportunities for outdoor recreation, adventure, and travel.

2. Cultural and anthropological resources

Sites important to the Alaskan culture were injured by the oil spill and by the cleanup response, mainly by increasing human activity in and around the spill area. Some Alaska Native sites in the spill area are more than 11,000 years old. The sites within the oil spill area fall within the larger ethnographic Pacific Eskimo region, which extends from the Copper River to the middle of the Alaska Peninsula and includes the outer reaches of Cook Inlet. Cook Inlet was originally occupied by the Tanaina Athapaskans. Trade, warfare, ceremonial exchange, and occasional intermarriage led to a sharing of many cultural traits among the Pacific Eskimo, Tanaina, Aleut, Eskimo, Athapaskan, Eyak, and Tlingit Indian tribes.

3. Subsistence

The term "subsistence" refers to a particular pattern of harvesting and using naturally occurring renewable resources. In a subsistence system, land and labor are allocated in accordance with kinship, political, or tribal rights and obligations. Subsistence systems define a relationship with the earth and its resources, shape the economy, provide material sustenance, and form the basis of community life. Subsistence systems depend on natural resources in a way that Western industrialized societies do not. Alaska is the only State in which a significant proportion of the population lives off the land.

The economic aspects of the subsistence system also are dependent upon the availability of untainted natural resources. In a subsistence economy, food and other material resources are bartered, shared, and used to supplement supplies from other sources. Subsistence resources are the foundation of the mixed subsistence-cash economy in the subsistence villages in the spill area.

It should be noted that none of the rural communities in spill area is so isolated or so traditional as to be totally uninvolved in the modern market economy. Most spill area communities are characterized by a mixed subsistence-market economy. This label recognizes that a subsistence sector exists alongside a cash system, and that the socioeconomic system is viable because the sectors are complementary and mutually supportive. Even the most traditional subsistence hunter uses the most modern rifles,

snow machines, boats, boat motors, nets, and traps he can afford. These goods cannot be acquired without cash.

Communities which rely substantially on subsistence in the spill area are listed below:

Akhiok	Ivanof Bay	Ouzinkie
Chenega Bay	Karluk	Perryville
Chignik Lagoon	Larsen Bay	Port Graham
Chignik Lake	Nanwalek	Port Lions
Chignik	Old Harbor	Tatitlek

6. Commercial Fishing

Commercial fishing within the oil spill area is divided among three census regions: Southcentral, which includes PWS and the outer Kenai Peninsula area; Kodiak, which surrounds Kodiak and Afognak Islands; and Bristol Bay, which includes the area between Kodiak and the Alaskan Peninsula.

The fishing industry in the oil spill area is primarily a small-boat near-shore fishery in contrast to the offshore highly capitalized fishery. The near shore fishery common in Prince William Sound, Cook Inlet, and Kodiak/Afognak Island area concentrates on seasonal salmon, herring, halibut, rockfish, black cod and to a lesser extent on Dungeness, king, and tanner (snow) crab. The offshore fishery located in the western Gulf of Alaska is found well offshore, concentrating on groundfish, king, and tanner crabs.

Table B-1. Fishing districts in within the oil spill area.

Region	Gear Type		
	Purse Seine and Beach Seine	Drift Gill Net	Set Net
Prince William Sound	Coghill, Unakwik, Northern, Eastern, Southeastern, Montague, and Southwestern	Coghill, Unakwik, Eshamy, and Copper River	Eshamy
Cook Inlet	Southern, Kamishak, Outer, Eastern, and Chitina Bay Subdistrict	Central	Southern (South side of Kamishak Bay and Port Graham Area), and Central
Kodiak	All districts	Northwest and Alitak	
Chignik	All districts		

7. Commercial Tourism

Tourism is Alaska's third-largest industry behind petroleum production and commercial fishing. Tourism was, and is, an industry of growing economic importance to the state.

Surveys have indicated that more than 750,000 people visited Alaska in 1989 from around the world, and of this number, 521,000 people visited in summer generating $304 million in summer revenue alone. The Southcentral region was the major beneficiary of visitor spending, capturing 44% of the $304 million.

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