11.13.05

Exxon Valdez Oil Spill Trustee Council

441 W. 5th Ave., Suite 500 • Anchorage, Alaska 99501-2340 • 907/278-8012 • fax 907/276-7178

MEMORANDUM

TO: Trustee Council Members

FROM: Molly McCammon
Executive Director

DATE: July 1, 2002

RE: Revised GEM Program Document

Following this memo you will find final drafts of the first 5 chapters of the revised GEM Program Document. I have not included chapters 6-9 (6 - Introduction to Scientific Background, 7 - Scientific Background, which now includes a revised Human Uses & Activities section, 8 – Modeling, and 9 – Data Management) because they are essentially support materials and have not changed substantively in content from the August 2001 version. In addition, the executive summary still needs to be revised to reflect the changed draft.

The heart of the GEM Program is in these 5 chapters. They have been significantly revised in response to the National Research Council review, although much of the revision was organizational in nature. Please note that Chapter 4 – Program Implementation - should be considered the starting point for further development of the GEM science plan. It will change over time. I strongly encourage you to read all 5 chapters carefully and hope you will be prepared to approve them at the July 9 meeting. If you have any questions about these, please call me as soon as possible.

Thank you.

Gulf of Alaska **E**cosystem **M**onitoring and Research Program (GEM)

The GEM Program Document.

Final Draft – July 1, 2002

Exxon Valdez Oil Spill Trustee Council

441 West 5th Avenue Suite 500
Anchorage, AK 99501-2340

www.oilspill.state.ak.us
restoration@oilspill.state.ak.us

907-278-8012
907-276-7178 fax
800-478-7745, within Alaska
800-283-7745, outside Alaska

GEM 2002 Final Draft 7/1/2002

Working Table of Contents

APPENDIX A. ACRONYMS AND WEB LINKS

Note: Not all of these acronyms and Web links are referenced in the GEM Program document. Many are included for general reference purposes.

ABC: Acceptable Biological Catch
ABWC: Alaska Beluga Whale Committee
ABSC (USGS): Alaska Biological Science Center (Biological Resources Division, U.S. Geological Survey)
http://www.absc.usgs.gov/research/seabird&foragefish/index.html
AC: Alaska Current
AC: Arctic Council
http://www.arctic-council.org/
ACC: Alaska Coastal Current
ACCE: Atlantic Climate and Circulation Experiment
ACIA: Arctic Climate Impact Assessment (Arctic Council)
http://www.acia.uaf.edu
ACRC: Alaska Climate Research Center,
http://climate.gi.alaska.edu/
ACT: Alliance for Coastal Technologies
http://www.actonline.ws/
ADCED: Alaska Department of Community and Economic Development
http://www.dced.state.ak.us/
ADCP: Acoustic Doppler Current Profilers
ADEC: Alaska Department of Environmental Conservation
http://www.state.ak.us/dec/home.htm
ADEM: Alabama Department of Environmental Management
http://www.adem.state.al.us/
ADEOS-II: Advanced Earth Observing Satellite-II
ADFG: Alaska Department of Fish and Game
Division of Commercial Fisheries: http://www.cf.adfg.state.ak.us/cf_home.htm
Division of Habitat: http://www.state.ak.us/adfg/habitat/hab_home.htm
Division of Subsistence: http://www.state.ak.us/adfg/subsist/subhome.htm
Division of Subsistence Whiskers Database
Division of Sport Fish: http://www.state.ak.us/adfg/sportf/sf_home.htm
ADHSS: Alaska Department of Health & Social Services
http://www.hss.state.ak.us/
ADNR: Alaska Department of Natural Resources
http://www.dnr.state.ak.us/
Division of Parks and Outdoor Recreation:
http://www.dnr.state.ak.us/parks
Division of Mining, Land and Water

http://www.dnr.state.ak.us/mlw
ADOT: Alaska Department of Transportation
http://www.dot.state.ak.us/
AEIDC: Artic Environmental Information and Data Center
http://www.urova.fi/home/arktinen/polarweb/polar/lbusaeid.htm
AEPS: Arctic Environmental Protection Strategy
AEWC: Alaska Eskimo Whaling Commission
AFSC: Alaska Fisheries Science Center (NOAA/NMFS)
http://www.afsc.noaa.gov/generalinfo.htm
AIS: Archival Information System
ALAMAP-C: Alabama's Monitoring and Assessment Program-Coastal
ALP: Aleutian low pressure
AMAP: Arctic Monitoring and Assessment Programme (Arctic Council)
http://www.amap.no/
AMHS: Alaska Marine Highway System
AMMC : Aleut Marine Mammal Commission
AMMTAP: Alaska Marine Mammal Tissue Archival Project
http://www.absc.usgs.gov/research/ammtap/intro.htm
AMNWR: Alaska Maritime National Wildlife Refuge
AMOS: Advanced Modelling and Observing System
AMSR: Advance Microwave Scanning Radiometer
ANHSC: Alaska Native Harbor Seal Commission
http://www.ptialaska.net/~aksealmr/
ANS: Alaska North Slope
ANS: Aquatic Nuisance Species (EPA)
AOC: Great Lakes Areas of Concern
AOSFRF: Alaskan Oceans, Seas, and Fisheries Research Foundation
http://www.alaskanoceans.org/welcome.html
APEX: Alaska Predator Ecosystem Experiment
AR: Alaska Region, NMFS
ARC: Atlantic Reference Center
ARCUS: Arctic Research Consortium of the United States
http://www.arcus.org
ARGO: Array for Real-time Geostrophic Oceanography
ARGO OPN: ARGO Ocean Profiling Network
http://www.argo.ucsd.edu
ARIES: Australian Resource Information and Environment Satellite
ARLIS: Alaska Resources Library and Information Service
http://www.arlis.org/index.html
ARMRB: Alaska Regional Marine Research Board
ARMRP: Alaska Regional Marine Research Plan
ARPA: Arctic Research and Policy Act (1984)
ASCC: Alaska State Climate Center
http://www.uaa.alaska.edu/enri/ascc_web/ascc_home.html

ASF: Alaska SAR (Synthetic Aperture Radar) Facility
http://www.asf.alaska.edu/
ASLC: Alaska SeaLife Center
http://www.alaskasealife.org/
ASOF: Arctic-Subarctic Ocean Flux Array
ASP: Amnesiac Shellfish Poisoning
ASTF: Alaska Science and Technology Foundation
http://www.astf.org
ATSDR: Agency for Toxic Substances and Disease Registry
http://www.atsdr.cdc.gov/
ATV: All Terrain Vehicle
AUV: Autonomous Underwater Vehicle
AVHRR: Advanced Very High Resolution Radiometer
AVSP: Alaska Visitor Statistics Program
AWC: Anchorage Waterway Council
http://www.anchwaterwayscouncil.org
AWQ: Division of Air and Water Quality, ADEC
http://www.state.ak.us/dec/dawq/dec_dawq.htm
BAHC: Biospheric Aspects of the Hydrological Cycle (IGBP)
BASS Task Team: Basin Scale Studies Task Team (PICES)
BATS: Bermuda Atlantic Time Series
BBMMC: Bristol Bay Marine Mammal Council
BBNA: Bristol Bay Native Association
http://www.bbna.com/
BCIS: Biodiversity Conservation Information System
http://www.biodiversity.org/simplify/ev.php
BDY: Beach Dynamics
BEACH: EPA's Beaches Environmental Assessment, Closure, and Health Program
BIO: Biological Oceanography Committee (PICES)
BOOS: Baltic Operational Oceanographic System
http://www.boos.org/
BRD: Biological Resources Division
C2000: EPA's National Coastal Assessment
CAAB: Codes for Australian Aquatic Biota
CACGP: Commission on Atmospheric Chemistry and Global Pollution
CAFF: Program for the Conservation of Arctic Flora and Fauna (Arctic Council)
http://www.caff.is/
CalCOFI: California Co-operative Fisheries Investigation program
http://www.calcofi.org/
CAOS: Co-ordinated Adriatic Observing System
CARIACO: Carbon Retention in a Colored Ocean Program
CARICOMP: Caribbean Coastal Marine Productivity
CAST: Council for Agricultural Science and Technology
http://www.cast-science.org/
CBMP: Chesapeake Bay Monitoring Program

CCAMLR: Commission for the Conservation of Antarctic Marine Living Resources
http://www.ccamlr.org
CCC: Cod and Climate Change (ICES/GLOBEC)
CCCC: Climate Change and Carrying Capacity (PICES/GLOBEC)
CCF: One hundred cubic feet
CCMP: NEP Comprehensive Conservation and Management Plan
CCS: California Current System
http://globec.oce.orst.edu/groups/nep/index.html
CDFO: Canadian Department of Fisheries and Oceans
http://www.dfo-mpo.gc.ca/home-accueil_e.htm
CDOM: Coloured Dissolved Organic Matter
CDQ: Community Development Quota
CEMP: CCAMLR Ecosystem Monitoring Program
http://www.ccamlr.org/English/e_sci_cttee/e_eco_monit/e_eco_monit_intro.htm
CENR: Committee on Environment and Natural Resources
http://www.ostp.gov/NSTC/html/committee/cenr.html
CEOS: Committee on Earth Observation Satellites
http://www.ceos.org/
CGOA: Coastal Gulf of Alaska
C-GOOS: Coastal Panel of GOOS
CHL: Chlorophyll
CHM: Clearing-House Mechanism of the Convention on Biological Diversity
CIFAR: Cooperative Institute for Arctic Research
http://www.cifar.uaf.edu
http://www.cifar.uaf.edu/fisheries.html
CIIMMS: Cook Inlet Information Management and Monitoring System
http://www.dnr.state.ak.us/ssd/ciimms/ciimms_sum2.html
CIK: Cook Inlet Keeper
http://www.inletkeeper.org/
CIMI: Computer Interchange of Museum Information
http://www.cimi.org/
CIRCAC: Cook Inlet Regional Citizens Advisory Council
http://www.circac.org/
CISeaFFS: Cook Inlet Seabird and Forage Fish Study
CISNet: Coastal Intensive Site Network
CISPRI: Cook Inlet Spill Prevention and Response, Inc.
CiSWG: Circumpolar Seabird Working Group (CAFF, IMCSAP, Arctic Council)
CLEMAN: Check List of European Marine Mollusca
CLiC: Climate and Cryosphere
http://clic.npolar.no/
CLIVAR: Climate Variability and Predictability Program
http://www.clivar.org/
C-MAN: Coastal Marine Automated Network
CMED/GMNET: Consortium for Marine and Estuarine Disease/Gulf of Mexico Network
CMI (MMS): Coastal Marine Institute

CMM: Commission for Marine Meteorology (of WMO)
CNES: Centre National d'Etudes Spatiales (France)
http://www.cnes.fr/
COADS: Comprehensive Ocean-Atmosphere Data Set
http://www.cdc.noaa.gov/coads
CODAR: Coastal Radar
COLORS: COastal region LOng-term measurements for colour Remote Sensing development and validation
COMBINE: COoperative Monitoring in the Baltic Marine Environment
CoML: Census of Marine Life
http://www.coml.org
CONNS: Coastal Observing Network for the Near Shore
Convention on Biological Diversity
http://www.biodiv.org/
COOP: Coastal Ocean Observation Panel
http://ioc.unesco.org/goos/COOP.htm
CoOP (NSF): Coastal Ocean Processes
http://www.skio.peachnet.edu/coop/
COP: Coastal Ocean Program
CORE: Consortium for Oceanographic Research and Education
http://www.coreocean.org/
Corexit 9500: Brand name of a dispersant from Exxon
Corexit 9527: Brand name of a dispersant from Exxon
COSESPO: Coastal Observing System for the Eastern South Pacific Ocean
COTS: Commercial off the shelf software
CPR: Advisory Panel on Continuous Plankton Recorder Survey in the North Pacific (PICES)
CPTEC: Center for Weather Forecasts and Climate Studies (Brasil)
http:// www.cptec.inpe.br/Fwelcomei.html
CRIS: Court Registry Investment System
CRP: Comprehensive Rationalization Program
CRRC: Chugach Regional Resource Commission
CRSA: Alaskan coastal resource service areas (CRSAs), see also CIAP
http://www.ocrm.nos.noaa.gov/czm/ciap/
CRTF: U.S. Coral Reef Task Force
CSCOR: Center for Sponsored Coastal Ocean Research
http://www.cop.noaa.gov/
CSIRO: Commonwealth Scientific and Industrial Research Organization
http://www.csiro.au/
CTD: Conductivity temperature versus depth
CTW: Coastal Trapped Waves
CU: cataloging unit
CVOA: Catcher Vessel Operational Area
CWAP: Clean Water Action Plan
CWPPRA: Coastal Wetlands Planning, Protection, and Restoration Act
CZCS: Coastal Zone Colour Scanner

CZM: Coastal Zone Management
DARP: Damage Assessment and Restoration Program
http://darcnw.noaa.gov/homepage.html
DARPA: Defense Advanced Research Projects Agency
http://www.darpa.mil/
DBCP: Data Buoy Cooperation Panel
DBMS: Database Management System
DCE: 1,2-dichloroethane
DDD: dichloro bis(p-chlorophenyl)ethane
DDE: Dichlorodiphenyldichloroethylene
DDT: Dichlorodiphenyltrichloroethane
DEOS: Deep Earth Observatories on the Seafloor
DEOS: Dynamics of Earth and Ocean Systems (CORE)
DFO: Department of Fisheries and Oceans, Canada
DGC: Division of Governmental Coordination, State of Alaska, Office of Governor
http://www.gov.state.ak.us/dgc/CIAP/CIAPhome.htm
DIN: Dissolved Inorganic Nitrogen
DMS: Dimethylsulphide
DNMI: Norwegian Meteorological Institute (Det norske meteorologiske institutt)
http://met.no/english/
DO: Dissolved Oxygen
DOC: U.S. Department of Commerce
DoD: U.S. Department of Defense
DODS: Distributed Oceanographic Data System
http://www.unidata.ucar.edu/packages/dods/
http://dods.gso.uri.edu/
DOE: U.S. Department of Energy
DOI: U.S. Department of the Interior
DON QUIJOTE: Data Observing Network for the QuIJOTe
DRBC: Delaware River Basin Commission
http://www.state.nj.us/drbc/drbc.htm
EA/RIR: Environmental Assessment/Regulatory Impact Review
EASy: Environmental Analysis System
EC: European Community
ECDIS: Electronic Chart and Display Information Systems
EC/IP: Executive Committee / Implementation Panel for CCCC (PICES)
ECMWF: European Centre for Medium Range Weather Forecasting
http://www.ecmwf.int/
ECOHAB (NSF): Ecology of Harmful Algal Blooms
EDOCC: Ecological Determinants of Ocean Carbon Cycling
http://picasso.edu.orst.edu/ORSOO/EDOCC/EDOCC.html
EDY: Estuarine Dynamics
EEZ: Exclusive Economic Zone
EEZ(A): European Economic Zone (Area)
EFH: Essential Fish Habitat

EGB (NSF): Environmental Geochemistry and Biogeochemistry
EIOA: European Oceanographic Industry Association
http://www.eoia.org/
ELOISE: European Land-Ocean Interaction Studies
EMAP: Environmental Monitoring and Assessment Program
http://www.epa.gov/emap/
http://yosemite.epa.gov/r10/oea.nsf/1887fc8b0c8f2aee882564800528583/f7a660b35e5d96df882568790053fc10?OpenDocument
EMAP-E: Environmental Monitoring and Assessment Program-Estuaries
Enersperse: Brand name of a dispersant
ENRI: Environment and Natural Resources Institute
http://www.uaa.alaska.edu/enri/enri_web/enrihome.html
ENSO: El Niño Southern Oscillation
EOS: NASA's Earth Observing System
EOSDIS: EOS Data and Information System
http://spsosun.gsfc.nasa.gov/NewEOSDIS_Over.html
EPA: U.S. Environmental Protection Agency
http://www.epa.gov/
ERMS: European Register of Marine Species
ERL: Effects Range Low (concentration of a contaminant potentially having adverse effects)
ERM: Effects Range Medium (concentration of a contaminant associated with adverse effects on organisms)
ERS-1: European Remote Sensing satellite-1
ERS-2: European Remote Sensing satallite-2
ESA: Endangers Species Act
ESH (NSF): Marine Aspects of Earth System History
ESIP: The Federation of Earth Science Information Partners
http://www.esipfed.org/
ESP: Eastern South Pacific
ESRI: Environmental Systems Research Institute
ArcIMS system: http://www.esri.com/software/arcims/index.html
ETL tools: Extraction, Transformation, and Loading tools
EU: European Union
EUMETSAT: European Organization for the Exploitation of Meteorological Satellites
http://www.eumetsat.de/en/
EuroGOOS: European GOOS
http://www.eurogoos.org/eurogoosindex.html
EuroHAB: European Harmful Algae Bloom
EVOS: Exxon Valdez Oil Spill http://www.oilspill.state.ak.us/
Bibliography: http://www.oilspill.state.ak.us/publications.html
Final and Annual Reports: http://www.oilspill.state.ak.us/pdf/Report_List_5-31-02.pdf
EXDET: An Exxon laboratory test for dispersants
F & A: Finance and Administration Committee (PICES)
FCCC: Framework Convention on Climate Change

Federal Geographic Data Committee metadata requirements:
http://www.fgdc.gov/metadata/metadata.html
Federal Subsistence Fishery Monitoring Program, Federal Subsistence Management Program
http://www.r7.fws.gov/asm/home.html
FDA: U.S. Food and Drug Administration
FGDC: Federal Geographic Data Committee
FIS: Fishery Science Committee (PICES)
Fishbase, FishGopher, FishNet: searchable fish databases managed by multiple organizations
FMP: Fishery Management Plan
FOCI: Fisheries Oceanography Coordinated Investigations
http://www.pmel.noaa.gov/foci/
F-R: Fundraising Committee (PICES)
FWS: U.S. Fish and Wildlife Service
FY: Fiscal Year
GAIM: Global Analysis, Interpretation and Modelling (IGBP)
GAK: Gulf of Alaska
GAK1: Gulf of Alaska station 1 located at the mouth of Resurrection Bay (60 N, 149W)
GAP: Gap Analysis Program
GARP: Genetic Algorithm for Rule-set Production
GBIF: Global Biodiversity Information Facility
GC: Governing Council (PICES)
GCM: Global Climate Model
GCN: Global Core Network
GCOS: Global Climate Observing System
http://193.135.216.2/web/gcos/pub/dim_v1_1.html
GCRMN: Global Coral Reef Monitoring Network
GCTE: Global Change and Terrestrial Ecosystems (IGBP)
GECaFS: Global Environmental Change and Food Systems (IGBP, WCRP, IDHP)
GEF: Global Environmental Facility
GEM: Gulf Ecosystem Monitoring
GEO: Global Eulerian Observations
GEOHAB: Global Ecology of Harmful Algal Blooms
GHL: Guideline Harvest Level
GIPME: Global Investigation of Pollution in the Marine Environment
GIS: Geographic Information System
GIWA: Global International Water Assessment
GLI: Global Imager
GLIFWC: Great Lakes Indian Fish and Wildlife Commission
http://www.glifwc.org/
GLNO: Great Lakes National Program Office
GLOBE: Global Learning and Observations to Benefit the Environment
http://www.globe.gov
GLOBEC: Global Ocean Ecosystem Dynamics
http://www.pml.ac.uk/globec/
GLOBEC U.S. http://cbl.umces.edu/fogarty/usglobec/

GLOBEC NEP: GLOBEC Northeast Pacific
http://globec.oce.orst.edu/groups/nep/index.html
GLORIA: Geological Long-Range Inclined Asdic
GLOSS: Global Sea-Level Observing System
GLWQA: Great Lakes Water Quality Agreement
GMBIS: Gulf of Maine Biogeographical Information System
GMP: Joint Gulf States Comprehensive Monitoring Program
GNP: Gross National Product
GOA: Gulf of Alaska
GODAE: Global Ocean Data Assimilation Experiment
http://www.bom.gov.au/bmrc/ocean/GODAE/
GOES: Geostationary Operational Environmental Satellite
GOFS: U.S. Global Ocean Flux Study
GOOS: Global Ocean Observing System
http://ioc.unesco.org/goos/
GOSIC: Global Observing System Information Center
http://www.gos.udel.edu
GPA/LBA: Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities
GPO: GOOS Project Office
GPS: Global Positioning System
GSC: GOOS Steering Committee
GTOS: Global Terrestrial Observing System
GTS: Global Telecommunications System
GUI: Graphical User Interface
HAB: harmful algal bloom
http://www.redtide.whoi.edu/hab
HABSOS: Harmful Algal Bloom Observing System
http://www.habhrca.noaa.gov
HAPC: Habitat Areas of Particular Concern
HELCOM: Helsinki Commission-Baltic Marine Environment Protection Commission
HMAP: History of Marine Animal Populations
HMS: Hydrometeorological Service
HNLC: high nitrate, low chlorophyll waters
HOTO: Health of the Oceans
HOTS: Hawaii Ocean Time Series
HPLC: High Performance Liquid Chromatography
IABIN: Inter-American Biodiversity Information Network
http://www.iabin.org/
IAI: Inter-American Institute
IARC: International Arctic Research Center, University of Alaska
http://www.iarc.uaf.edu/
IARPC: Interagency Arctic Research Policy Committee
http://www.nsf.gov/od/opp/arctic/iarpc/start.htm
IBOY: International Biodiversity Observation Year

IBQ: Individual Bycatch Quota
ICAM: Integrated Coastal Area Management/ Integrated Coastal Area Management Programme
ICES: International Council for the Exploration of the Sea
http://www.ices.dk/
ICLARM: International Center for Living Aquatic Resources Management
http://www.iclarm.org/
ICM: Integrated Coastal Management
ICSU: International Council for Science
ICZN: International Code of Zoological Nomenclature
IFEP: Iron Fertilization Experiment Panel (PICES)
IFO: Intermediate Fuel Oil
IFP: The French Petroleum Institute
http://www.ifp.fr/
IFQ: Individual Fishing Quota
IGAC: International Global Atmospheric Chemistry Project (IGBP/CACGP)
http://www.igac.unh.edu/
IGBP: International Geosphere-Biosphere Programme
http://www.igbp.kva.se/
IGBP-DIS: Data and Information System (IGBP)
I-GOOS: IOC-WMO-UNEP Committee for the Global Ocean Observing System
IGOS (NASA): Integrated Global Observing System
http://www.igospartners.org
IGOSS: Integrated Global Ocean Services System
IGS: International GPS Service for Geodynamics
IGU: International Geographic Union
IHDP: International Human Dimensions Programme on Global Environmental Change
IHDP: International Human Dimensions Programme (IGBP et al.)
http://www.uni-bonn.de/ihdp/IIP: International Ice Patrol
IJC: International Joint Commission
I-LTER: International LTER
IMCSAP: International Murre Conservation Strategy and Action Plan (CAFF, Arctic Council)
IMS: Institute of Marine Science, University of Alaska
http://www.ims.uaf.edu/
InfoBOOS: BOOS Information System
INPFC: International North Pacific Fisheries Commission
http://www.npafc.org/inpfc/inpfc.html
IOC: Intergovernmental Oceanographic Commission (of UNESCO)
http://ioc.unesco.org/iyo/
IOCCG: International Ocean Colour Coordinating Group
http://www.ioccg.org/
IODE: International Oceanographic Data and Information Exchange
http://ioc.unesco.org/iode/
IOOS: Integrated Ocean Observing System
http://core.ssc.erc.msstate.edu/oceanobs.html
IPCC: Intergovernmental Panel on Climate Change

http://www.ipcc.ch/
IPHAB: Intergovernmental Panel on HABs
IPHC: International Pacific Halibut Commission
http://www.iphc.washington.edu/
IPRC: International Pacific Research Center
http://iprc.soest.hawaii.edu/
IPSFC: International Pacific Salmon Fishing Commission
IRFA: Initial Regulatory Flexibility Analysis
IRIU: Improved Retention/Improved Utilization
ITAC: Initial Total Allowable Catch
ITIS: Integrated Taxonomic Information System
ITSU: IOC Tsunami Warning System in the Pacific
IUCN: The World Conservation Union
IWI: EPA's Index of Watershed Indicators
JCOMM: Joint Technical Commission for Oceanography and Marine Meteorology
JDBC: Java Database Connectivity
JDIMP: Joint Data and Information Management Panel
JGOFS (NSF): Joint Global Ocean Flux Study
http://ads.smr.uib.no/jgofs/jgofs.htm
KBNERR: Kachemak Bay National Estuarine Research Reserve
http://www.state.ak.us/local/akpages/FISH.GAME/habitat/geninfo/nerr/
Kachemak Bay Ecological Characterization study
http://www.state.ak.us/adfg/habitat/geninfo/nerr/kbec/index.htm
KRSA: Kenai River Sportfishing Association
LaMP: Lakewide Management Plan (EPA)
LAMP: Local Area Management Plan
LATEX: Louisiana-Texas shelf study
LC50 or LC_{50}: Lethal concentration of 50%of the test population
LEO: Long-term Ecosystem Observatory
LEO-15: Long-term Ecosystem Observatory at 15-m depth
LExEn (NSF): Life in Extreme Environments
LIDAR: Light Detection and Ranging
LLP: License Limitation Program
LMR: Living Marine Resources
LOICZ: Land-Ocean Interactions in Coastal Zone
LTER: Long-term Ecological Research (NSF) http://lternet.edu/
LTOP: Long-Term Observation Program
http://globec.oce.orst.edu/groups/nep/index.html
LUCC: Land Use/Cover Change (IGBP/IHDP)
MABNET: Man and the Biosphere Network
MARBID: Marine Biodiversity Database
MARGINS (NSF): Continental Margins
MarLIN: Marine Laboratories Information Network
http://www.marine.csiro.au/marlin/
MAROB: Marine Observation

MAST: Marine Science and Technology
MBARI: Monterey Bay Aquarium Research Institute
http://www.mbari.org/about/
MBF: One thousand board feet
MBMAP: Advisory Panel on Marine Birds and Mammals (PICES)
MBNMS: Monterey Bay National Marine Sanctuary
http://bonita.mbnms.nos.noaa.gov/research/mb_workshop/index.html
MEHRL: Marine Environmental Health Research Laboratory
www.cofc.edu/~grice/hml
MEL: Master Environmental Library
MEQ: Marine Environmental Quality Committee (PICES)
MERIS: Medium Resolution Imaging Spectrometer
MetOp: Meteorological Operational
MFS: Mediterranean Forecasting System
MMPA: Marine Mammal Protection Act
MMRC: The North Pacific Universities Marine Mammal Research Consortium
http://www.zoology.ubc.ca/~consort/consortm.htm
MMS: Minerals Management Service
MMS OCSES: Outer Continental Shelf Environmental Studies
MNS: Mackay, Nadeau, Steelman
MODEL: Conceptual / Theoretical and Modeling Studies Task Team (PICES)
MODIS: Moderate Resolution Imaging Spectroradiometer
MODMON: Neuse Monitoring and Modeling Project
MONITOR: Monitor Task Team (PICES)
MOOS: Ocean Observing System of the Monterey Bay Aquarium Research Institute
http://www.mbari.org/default.htm
MOS: Modular Optoelectronic Scanner
MPA: Marine Protected Areas (DOC/DOI)
http://www.mpa.gov
MPN: Most Probable Number
MRB: Maximum Retainable Bycatch
MSFCMA: Magnuson-Stevens Fishery Conservation and Management Act
MSY: Maximum Sustainable Yield
mt: Metric tons
MWRA: Massachusetts Water Resources Authority
http://www.mwra.state.ma.us/
NA: Northern Adriatic
NABIN: North American Biodiversity Information Network
NABIS: National Aquatic Biodiversity Information Strategy
NAML: National Association of Marine Laboratories
http://hermes.mbl.edu/labs/NAML/
NAO: North Atlantic Oscillation
NAS: Nonindigenous Aquatic Species
NASA: National Aeronautics and Space Administration
http://www.nasa.gov/

NASA/AMSR: Advance Microwave Scanning Radiometer:
http://wwwghcc.msfc.nasa.gov/AMSR/
Earth Science Enterprise: http://www.earth.nasa.gov
NASA/GRACE: Gravity Recovery and Climate Experiment:
http://essp.gsfc.nasa.gov/esspmissions.html
NASA/NASDA Tropical Rainfall Measurement Mission:
http://modis.gsfc.nasa.gov/
NASA/Salinity and Sea Ice Working Group:
http://www.esr.org/lagerloef/ssiwg/ssiwgrep1.v2.html
NASA/SeaWiFS:
http://seawifs.gsfc.nasa.gov
NASQAN: National Stream Quality Accounting Network
http://water.usgs.gov/nasqan/
Naval Oceanographic Office
http://128.160.23.51/noframe/select.products.htm
NAWQA: National Water Quality Assessment Program
http://water.usgs.gov/nawqa/
NCAR: National Center for Atmospheric Research
NCDC: National Climate Data Center
http://www.ncdc.noaa.gov/
NCDDC: National Coastal Data Development Center
http://www.ncddc.noaa.gov/
NCEP: National Centers for Environmental Protection
NDBC: National Data Buoy Center
NDVI: Normalized Difference Vegetation Index
NEAR-GOOS: North East Asian GOOS
NEMO: Naval Earth Map Observer
NEODAT: Inter-Institutional Database of Fish Biodiversity in the Neotrophics
NEP: National Estuary Program
NERR: National Estuarine Research Reserve
NERRS: National Estuarine Research Reserve System
NESDIS: National Environmental Satellite, Data, and Information Service
NGO: Non-governmental organization
NGOA: Northern Gulf of Alaska
NGOS: North Gulf Oceanic Society
http://www.whalesalaska.org/
NIST: National Institute of Standards and Technology
http://www.nist.gov/
NIWA: National Institute of Water and Atmosphere Research
NLFWA: National Listing of Fish and Wildlife Advisories
NMFS: National Marine Fisheries Service
http://www.nmfs.noaa.gov/
NMMHSRP: National Marine Mammal Health and Stranding Response Program
http://www.nmfs.noaa.gov/prot_res/overview/mm.html
NMML: National Marine Mammal Laboratory

NMS: National Marine Santuary
NOAA: National Oceanic and Atmospheric Administration
NOAA HAZMAT: Hazardous Materials Program
NOAA NOS: National Ocean Service
NODC: National Oceanographic Data Center
http://www.nodc.noaa.gov
NOEL: No-Effect Level
NOLS: National Outdoor Leadership School
NOPP (NASA): National Ocean Partnership Program
http://www.NOPP.org
NOPPO: National Oceanographic Partnership Program Office
NORLC: National Ocean Research Leadership Council
NORPAC: North Pacific; an informally organized group of scientists responsible for collating and publishing much of the oceanographic data collected in the North Pacific Ocean during the period of approximately 1930 to 1965. These data were published in several volumes by the University of California Press. This data set is collectively known as the NORPAC data.
NOS: NOAA's National Ocean Service
http://www.nos.noaa.gov/
NO_x: Nitrogen Oxides
NPAFC: North Pacific Anadromous Fish Commission
http://www.npafc.org
NPDES: National Pollution Discharge Elimination System
NPFMC: North Pacific Fishery Management Council
NPMRP: North Pacific Marine Research Program
http://www.sfos.uaf.edu/npmr/index.html
NPO: North Pacific Oscillation
NPOESS: National Polar-Orbiting Environmental Satellite System
NPPSD: North Pacific Pelagic Seabird Database
http://www.absc.usgu.gov/research/NPPSD/
NPS: National Park Service
NPUMMRC: North Pacific Universities Marine Mammal Research Consortium
http://www.zoology.ubc.ca/~consort/consortm.htm
NRA: NASA Research Announcment
NRC: National Research Council
NRDA: natural resource damage assessment
NRT: Near Real Time
NS&T: National Status and Trends Program
http://ccmaserver.nos.noaa.gov/NSandT/New_NSandT.html
NSF: National Science Foundation
NSIPP (NASA): Seasonal-to-Interannual Prediction Program
NSTC: National Science and Technology Council
NURP (NOAA): National Undersea Research Program
NVODS: National Virtual Ocean Data System
http://nvods.org/
NVP: Nearshore Vertebrate Predator project

NWI: National Wetlands Inventory
NWIFC: Northwest Indian Fisheries Commission
NWP: numerical weather prediction
NWS: National Weather Service
http://www.nws.noaa.gov/
OAR: Office of Oceanic and Atmospheric Research (NOAA)
http://oar.noaa.gov/
OBIS: Ocean Biogeographical Information System
www.coml.org
OCC: Ocean Carrying Capacity
OCRM: Office of Coastal Resource Management, NOS, NOAA
http://www.ocrm.nos.noaa.gov/
OCSEAP: Outer Continental Shelf Environmental Assessment Program
OCTET: Ocean Carbon Transport, Exchanges and Transformations
http://www.msrc.sunysb.edu/octet/
OCTS: Ocean Color and Temperature Scanner
OE (NOAA OAR) Office of Ocean Exploration
http://oceanpanel.nos.noaa.gov/
OECD: Organization for Economic Co-operation and Development
OFP: Ocean Flux Program
OHMSETT: Oil and Hazardous Materials Simulated Environmental Test Tank
OMB: Office of Management and Budget
ONR: Office of Naval Research
OOPC: Ocean Observations Panel for Climate
OOSDP: Ocean Observing System Development Panel
OPA 90: Oil Pollution Act of 1990
http://www.pwssc-osri.org/docs/opa90.html
OPR: Office of Protected Resources
http://www.nmfs.noaa.gov/prot_res/prot_res.html
ORAP: Ocean Research Advisory Panel
ORNL: Oak Ridge National Laboratory
OSNLR: Ocean Science in Relation to Non-Living Resources
OSPARCOM: Convention for the Protection of the Marine Environment of the North-east Atlantic
OSRI: Prince William Sound Oil Spill Recovery Institute
http://www.pwssc-osri.org
OSSE: Observation System Simulation Experiments
OST: EPA's Office of Science and Technology
OSTP: Office of Science and Technology Policy
OWOW: EPA's Office of Wetlands, Oceans, and Watersheds
OY: Optimum yield
PAG: Public Advisory Group
PAGES: Past Global Change (IGBP)
http://www.pages.unibe.ch/
PAH: Polycyclic Aromatic Hydrocarbons (EPA)

PAH: Polynuclear Aromatic Hydrocarbons
PAR: Phosynthetically Available Radiation
PC: Publication Committee (PICES)
PCAST: President's Committee of Advisors on Science and Technology
http://www.ostp.gov/PCAST/pcast.html
PCB: Polychlorinated biphenyls
PCC: Pollock Conservation Cooperative
PDO: Pacific Decadal Oscillation
PICES: North Pacific Marine Science Organization (not an acronym)
http://pices.ios.bc.ca/
PIRATA: Pilot Research Array in the Tropical Atlantic
PISCO: Partnership for the Interdisciplinary Study of Coastal Oceans
http://www.piscoweb.org/
PMEL: Pacific Marine Environmental Laboratory
http://www.pmel.noaa.gov/
PMEL Bering Sea and North Pacific Ocean Theme Page:
www.pmel.noaa.gov/bering
POC: Physical Oceanography and Climate Committee (PICES)
POLDER: Polarization and Directionality of the Earth's Reflectances
POM: Princeton Ocean Model
PORTS: Physical Oceanographic Real-Time System
PORTS/VTS: PORTS/Vessel Traffic Services
POST: Pacific Ocean Salmon Tracking Project
POTW: Publicly Owned Treatment Works
PRODAS: Prototype Ocean Data Analysis System
PROFC: Programa Regional de Oceanografia Fisica y Clima
http://www.profc.udec.cl/
PSAMP: Puget Sound Ambient Monitoring Program
http://www.wa.gov/WDFW/fish/psamp/index.htm
PSC: Pacific Salmon Commission
http://www.psc.org/Index.htm
PSMFC: Pacific States Marine Fisheries Commission
http://www.psmfc.org/
PSMFC Regional Mark Processing Center:
http://www.rmis.org/index.html
PSP: Paralytic Shellfish Poisoning
PST: Pacific Salmon Treaty
PWS: Prince William Sound
PWSAC: PWS Aquaculture Corporation
http://www.ctcak.net/~pwsac/
PWSRCAC: PWS Regional Citizens Advisory Council
http://pwsrcac.org/index.html
PWSSC: Prince William Sound Science Center
http://www.pwssc.gen.ak.us/pwscc/pwscc.html
QAQC: Quality Assurance and Quality Control

QC: quality control
QUIJOTE: Quickly Integrated Joint Observing Team
R&D: Research and Development
RACE: Resource Assessment and Community Ecology
RAMS: Regional Atmospheric Modeling System
RAP: Remedial Action Plan
RCAC: Regional Citizens Advisory Council
RCRA: Resource Conservation and Recovery Act
RDP: Ribosomal Database Project
REX: Regional Experiments Task Team (PICES)
RFP: Request for Proposals
RIDGE (NSF): Ridge Interdisciplinary Global Experiments
RLDC: Responsible Local Data Center
RMI: Remote Method Invocation
RMP: Regional Monitoring Program
RNODC: Responsible National Oceanographic Data Center
RSN: RedSur Network
http://www.cem.ufpr.br/fisica/redsur.htm
S1: Session 1 - Science Board Symposium on Subarctic gyre processes and their interaction with coastal and transition zones: physical and biological relationships and ecosystem impacts (PICES)
S2: Session 2 - BIO Topic Session on Prey consumption by higher trophic level predators in PICES regions: implications for ecosystem studies (PICES)
S3: Session 3 - Joint BIO / CCCC Topic Session on Recent progress in zooplankton ecology study in PICES regions (PICES)
S4: Session 4 - FIS Topic Session on Short life-span quid and fish as keystone species in North Pacific marine ecosystems (PICES)
S5: Session 5 - POC Topic Session on Large-scale circulation in the North Pacific (PICES)
S6: Session 6 - Joint POC / BIO Topic Session on North Pacific carbon cycling and ecosystem dynamics (PICES)
S7: Session 7 - CCCC Topic Session on Recent findings and comparisons of GLOBEC and GLOBEC-like programs in the North Pacific (PICES)
S8: Session 8 - MEQ Topic Session on Environmental assessment of Vancouver Harbour: results of an international workshop (PICES)
S9: Session 9 - MEQ Topic Session on Science and technology for environmentally sustainable mariculture in coastal areas (PICES)
SAFE: Stock Assessment and Fishery Evaluation Document
SALMON (Sea-Air-Land Monitoring and Observation Network)
http://www.ims.uaf.edu:8000/salmon/
SALSA: Semi-arid Land Surface Atmosphere Program
http://www.tucson.ars.ag.gov/salsa/salsahome.html
SAR: Synthetic Aperture Radar
SAV: Submerged Aquatic Vegetation
SB: Science Board (PICES)
SBIA (NSF): Shelf-basin Interactions in the Arctic

SCAMIT: Southern California Association of Marine Invertebrate Taxonomists
http://www.scamit.org/
SCB: Southern California Bight
SCBPP: Southern California Bight Pilot Project
SCCWRP: Southern California Coastal Water Research Project
http://www.sccwrp.org/
SCDHEC: South Carolina Department of Health and Environmental Control
http://www.scdhec.net/
SCDNR: South Carolina Department of Natural Resources
http://www.dnr.state.sc.us/
SCECAP: South Carolina Department Estuarine and Coastal Assessment Program
SC(-IGBP): Scientific Committee for the IGBP
SCICEX (NSF): Science Ice Exercise
SCOPE: Scientific Committee on Problems of the Environment
http://www.icsu-scope.org/
SCOR: Scientific Committee on Oceanic Research
http://www.jhu.edu/~scor/
SCS: South China Sea
SEA: Sound Ecosystem Assessment
http://www.pwssc.gen.ak.us/sea/sea.html
SEARCH: Study of Environmental Arctic Change
http://psc.apl.washington.edu/search/index.html
SEAS: Shipboard Environmental Data Acquisition System
SeaWIFS: Sea-viewing Wide Field-of-view Sensor
SEI: Special Events Imager
SEPOA: Southeast Pacific Ocean Array
SERC: Smithsonian Environmental Research Center
http://www.serc.si.edu/
SERVS: Ship Escort Response Vessel System
SFEP: San Francisco Estuary Project
http://www.abag.ca.gov/bayarea/sfep/sfep.html
SFOS: School of Fisheries and Ocean Sciences, University of Alaska Fairbanks
http://www.sfos.uaf.edu/
SG: Sea Grant
http://www.nsgo.seagrant.org/
SGI: State of the Gulf Index
SHEBA (NSF): Surface Heat Budget of the Arctic Ocean
SIMBIOS: Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies
SIMoN: Sanctuary Integrated Monitoring Network
http://www.mbnms.nos.noaa.gov/Research/simon/simon.htm
SJBEP: San Juan Bay Estuary Program
http://www.estuariosanjuan.org/
SLFMR: Scanning Low Frequency Microwave Radiometers
SO-GLOBEC: Southern Ocean Programme (GLOBEC)

SOIREE: Southern Ocean iron release experiment
http://katipo.niwa.cri.nz/~hadfield/gust/iron
SOLAS: International Convention for Safety of Life at Sea
SOLAS: Surface Ocean Lower Atmosphere Study (NRC)
SOLEC: State of the Lakes Ecosystem Conference
SPACC: Small Pelagic Fish and Climate Change (GLOBEC)
Specimen Banking Project
http://www.nwfsc.noaa.gov/pubs/tm/tm16/tm16.htm
SQuID: Structured Query and Information Delivery
SSC: Scientific and Statistical Committee
SSE (NOAA): Sustainable Seas Expedition
http://www.sustainableseas.noaa.gov/
SSF: Storm Surge Forecast System
SSH: Sea Surface Height
SSLRI : Steller Sea Lion Research Initiative (NMFS, AR)
http://www.fakr.noaa.gov/omi/grants/sslri
SSM/I: Special Sensor Microwave/Imager
SSS: Sea Surface Salinity
SST: Sea Surface Temperature
STAMP: Seabird Tissue Archival and Monitoring Project
START: Global Change System for Analysis, Research and Training (IGBP)
http://www.start.org/
STD: Salinity Temperature Depth recorder
STORET System (EPA)
http://www.epa.gov/storet
SVOC: Semivolatile Organic Compounds
SWAO: South Western Atlantic Ocean
SWMP: NERRS System-Wide Monitoring Program
http://inlet.geol.sc.edu/cdmoweb/home.html
TAC: Total Allowable Catch
TAO: Tropical Atmosphere Ocean (buoy array)
TASC: Transatlantic Study of Calanus finmarchicus (EU)
TCE: Tetracholoroethane
TCODE: Technical Committee on Data Exchange (PICES)
TCP: Tropical Cyclone Programme
http://www.wmo.ch/web/www/TCP/trop-cyc.html
TEMA: Training, Education and Mutural Assistance (IOC)
TMDL: Total Maximum Daily Load
TOGA: Tropical Ocean and Global Atmosphere
TOPEX/Poseiden
http://topex-www.jpl.nasa.gov
T/P: TOPEX/Poseidon
UAA: University of Alaska, Anchorage
http://www.uaa.alaska.edu/
UAF: University of Alaska, Fairbanks

http://www.uaf.edu/
UN: United Nations
UNCED: The United Nations Conference on Environment and Development
UNCLOS: United National Convention on the Law of the Sea (Montego Bay, 1982)
UNEP: United Nations Environmental Programme
http://www.unep.org/
UNESCO: United Nations Educational, Scientific and Cultural Organization
http://ioc.unesco.org/iocweb/
UNFCCC: United Nations Framework Convention on Climate Change
http://unfccc.int/
USARC: U.S. Arctic Research Commission
http://www.uaa.alaska.edu/enri/arc_web/archome.htm
USCG: U.S. Coast Guard
http://www.uscg.mil/uscg.shtm
USDA: U.S. Department of Agriculture
http://www.usda.gov/
USDHHS: U.S. Department of Health and Human Services
http://www.os.dhhs.gov/
USFS: U.S. Forest Service
USGCRP: U.S. Global Change Research Program
http://www.usgcrp.gov/usgcrp/nacc/default.htm
US GLOBEC (NSF): U.S. Global Ocean Ecosystem Dynamics
http://cbl.umces.edu/fogarty/usglobec/
USGS: U.S. Geological Survey
http://www.usgs.gov
USNO: U.S. Naval Observatory
http://www.usno.navy.mil/
UWA: Unified Watershed Assessments
VBA: Vessel Bycatch Accounting
VENTS (NOAA): Vents Program
http://www.pmel.noaa.gov/vents/home.html
VIP: Vessel Incentive Program
VOC: Volatile Organic Compounds
VOS: Volunteer Observing Ships
W1: Workshop 1 - MONITOR Workshop on Progress in monitoring the North Pacific (PICES)
W2: Workshop 2 - REX Workshop on Trends in herring populations and trophodynamics (PICES)
W3: Workshop 3 - MODEL Workshop on Strategies for coupling higher and lower trophic level marine ecosystem models (PICES)
W4: Workshop 4 - BASS Workshop of Development of a conceptual model of the Subarctic Pacific basin ecosystem(s) (PICES)
W5: Workshop 5 - IFEP Planning Workshop on Designing the iron fertilization experiment in the Subarctic Pacific (PICES)
W6: Workshop 6 - (BIO / MBMAP) - The basis for estimating the abundance of marine birds and mammals, and the impact of their predation on other organisms (PICES)

W7: Workshop 7 - CO2 Data Synthesis Symposium (PICES)
WAF: Water-Accommodated Fraction
WAM: Wave Model
WCRP: World Climate Research Programme (ICSU/IOC/WMO)
http://www.wmo.ch/web/wcrp/wcrp-home.html
WDFW: Washington Department of Fish and Wildlife
http://www.wa.gov/wdfw/
WDOE: Washington Department of Ecology
http://www.ecy.wa.gov/ecyhome.html
WES: Waterways Experimental Station
WESTPAC: IOC Sub-Commission for the Western Pacific
http://ioc.unesco.org/westpac/index.htm
WG: Working Group (PICES)
WHOI: Woods Hole Oceanographic Institution
http://www.whoi.edu/
WMO: World Meteorological Organization
http://www.wmo.ch/index-en.html
WMS: Open GIS Consortium's Web Mapping Server
http://www.opengis.org/techno/specs/01-047r2.pdf
WOCE (NSF): World Ocean Circulation Experiment (WCRP)
http://www.soc.soton.ac.uk/OTHERS/woceipo/ipo.html
WODC: World Oceanographic Data Center
WOOD: Worldwide Ocean Optics Database
http://wood.jhuapl.edu/
WSRI: Wild Stock Restoration Initiative
WWW: World Weather Watch
http://youth.net/weather/welcome.html
XBT: expendable bathythermograph
XCDT: expendable conductivity, depth and salinity devices

1. VISION

In This Chapter

- Origin of the GEM Program
- Mission and Goals Identified for the Program
- Geographic Scope, Funding and Governance
- Building on Lessons of the Past

1.1 Introduction

On March 24, 1989, the *T/V Exxon Valdez* ran aground on Bligh Reef in Prince William Sound, spilling almost 11 million gallons of North Slope crude oil. The event was the largest tanker spill in U.S. history, contaminating approximately 1,500 miles of Alaska's coastline, killing birds, mammals and fish, and disrupting the ecosystem in the path of the spreading oil. In 1991, the Exxon Corporation agreed to pay the United States and the State of Alaska $900 million over 10 years to restore, replace, enhance, or acquire the equivalent of natural resources injured by the spill, and the reduced or lost human services they provide (United States of America and State of Alaska 1991). Under the court-approved terms of the settlement, the *Exxon Valdez* Oil Spill Trustee Council (Trustee Council) was formed to administer the restoration funds, and in 1994 the *Exxon Valdez* Oil Spill Restoration Plan was adopted to guide the development and implementation of a comprehensive, interdisciplinary recovery and rehabilitation program.

Thirteen years after the spill, total recovery has still not been achieved. Appendix B presents the current information regarding the recovery status of resources injured by the spill. There are still two main concerns about lingering effects of the spill. The first is the potential effect of pockets of residual oil in the environment. The second concern is the ability of a population to fully recover by overcoming changes in the population dynamics resulting from the initial oil-related mortalities and the interaction of these effects with those of other kinds of changes and disturbances in the marine ecosystem.

The knowledge and experience gained during years of biological and physical studies in the aftermath of the *Exxon Valdez* oil spill (EVOS) confirmed that a solid historical context is essential to understand the sources of changes in valued natural resources. Toward this end, in March 1999 the Trustee Council dedicated approximately $120 million for long-term monitoring and ecosystem-based research in the northern Gulf of Alaska (GOA). This new program is called the GEM (the Gulf of Alaska Ecosystem Monitoring and Research) program. Funding

for the GEM program comes from an endowment, with an annual program funded through investment earnings, after allowing for inflation-proofing and modest growth of the corpus.

A program rooted in the science of a large-scale ecological disaster is uniquely suited to form the foundation for ecosystem-based management. In making the decision to allocate these funds for a long-term program of monitoring and research, the Trustee Council explicitly recognized that complete recovery from the oil spill may not occur for decades, and that full restoration of these resources will most likely be achieved through long-term observation and, as needed, restoration actions. The Trustee Council further recognized that conservation and improved management of these resources and services would require substantial ongoing investment to improve understanding of the marine and coastal ecosystems that support the resources, as well as the people, of the spill region. Improving the quality of information available to resource managers should result in improved resource management. In addition, prudent use of the natural resources of the spill area without compromising their health and recovery requires increased knowledge of critical ecological information about the northern GOA. This knowledge can only be provided through a long-term monitoring and research program that will span decades, if not centuries.

Prudent use of the natural resources of the spill area requires increased knowledge of critical ecological information about the northern GOA.

1.2 Mission

The original mission of the Trustee Council's Restoration Program, adopted in 1993, was to "efficiently restore the environment injured by the EVOS to a healthy, productive, world-renowned ecosystem, while taking into account the importance of the quality of life and the need for viable opportunities to establish and sustain a reasonable standard of living."

Consistent with this mission and with the ecosystem approach to restoration adopted by the Trustee Council in the 1994 *Exxon Valdez* Oil Spill Restoration Plan, the mission of the GEM program is to:

> ***Sustain a healthy and biologically diverse marine ecosystem in the northern Gulf of Alaska (GOA) and the human use of the marine resources in that ecosystem through greater understanding of how its productivity is influenced by natural changes and human activities.***

In pursuit of this mission, the GEM program will accomplish the following:

- Sustain the necessary institutional infrastructure to provide scientific leadership in identifying research and monitoring gaps and priorities;

- Sponsor monitoring, research, and other projects that respond to these identified needs;
- Encourage efficiency in and integration of GOA monitoring and research activities through leveraging of funds and interagency coordination and partnerships; and
- Promote local stewardship by involving stakeholders and having them help plan, guide, and carry out parts of the GEM program.

In adopting this mission, the Trustee Council acknowledges that, at times, sustaining a healthy ecosystem and ensuring sustainable human uses of the marine resources may be in conflict. In those instances, the goal of achieving a healthy ecosystem will be paramount. The Trustee Council also acknowledges that, at this time, clearly defined measures for assessing "ecosystem health" are lacking (NRC 2000). These measures will be incorporated into the program as they are developed.

1.3 Goals

Five major goals have been identified as necessary to accomplish the GEM mission. Attaining all five, however, will require several decades. Two of these goals may be attainable within the early decades of operating the GEM program, given sufficient funding and collaboration with other partners:

1. **Detect:** Serve as a sentinel (early warning) system by detecting annual and long-term changes in the marine ecosystem, from coastal watersheds to the central gulf; and
2. **Understand:** Identify causes of change in the marine ecosystem, including natural variation, human influences, and their interaction.

Two other goals provide an essential piece of the foundation for a long-term program. Although these goals are likely to be fully realized only after the first decade of operating the GEM program, shorter-term accomplishments should be achieved sooner:

3. **Inform:** Provide integrated and synthesized information to the public, resource managers, industry and policy makers in order for them to respond to changes in natural resources; and
4. **Solve:** Develop tools, technologies and information that can help resource managers and regulators improve management of marine resources and address problems that may arise from human activities.

The fifth goal is inherently long-term and difficult to achieve, but of considerable potential value to resource users and managers. It serves more as a long-range beacon to guide the design of monitoring activities, than as a goal to be attained within the near term:

5. **Predict:** Develop the capacity to predict the status and trends of natural resources for use by resource managers and consumers.

During the process of learning how to detect and understand change in the northern GOA, resource managers and the concerned public should collect incremental dividends on their investment in GEM. Ultimately, however, the benefits will be maximized over the long run. To fully achieve its mission, GEM must provide information that enables resource-dependent people, such as subsistence users, recreationalists, and commercial fishers, to better understand and therefore hopefully cope with changes in marine resources. The data and information produced by GEM during its first decade may not totally solve problems for the public, commercial interests, resource managers, and policy makers faced with environmental change. Nonetheless, as information accumulates, the ability for GEM to provide problem-solving information and tools can and must increase.

Given the size and complexity of the northern GOA ecosystem and the available funding, it will not be possible to meet these goals with only the data collected by GEM. Addressing the program goals will require achieving the following implementation goals:

- **Lead** the way in integrating, synthesizing, and interpreting monitoring and research results to form and convey a "big picture" of the status of and trends in the GOA ecosystem;
- **Track** work of other entities relevant to understanding biological production in the GOA and **coordinate** GEM with those efforts;
- **Leverage** funds to augment ongoing monitoring work funded by other entities;
- **Involve** other government agencies, non-governmental organizations, stakeholders, policy makers, and the general public in a collaborative process to achieve the mission and goals of GEM;
- Increase **community involvement** and **local and traditional knowledge** in order to enhance long-term **stewardship** of living marine resources; and
- **Facilitate** application of GEM research and monitoring results to benefit conservation and management of marine resources.

The substantial experience of the EVOS Restoration Program indicates that these six implementation goals are reasonable, necessary, and attainable.

1.4 Geographic Scope

Consistent with the Restoration Plan, GEM program activities will occur within the area affected by the 1989 oil spill, which is generally the northern GOA, including Prince William Sound (PWS), Cook Inlet, Kodiak Island, and the Alaska Peninsula (Figure 1.1). Recognizing that the marine ecosystems affected by the oil spill do not have discrete boundaries, some monitoring and research activities may extend into adjacent areas of the northern GOA.

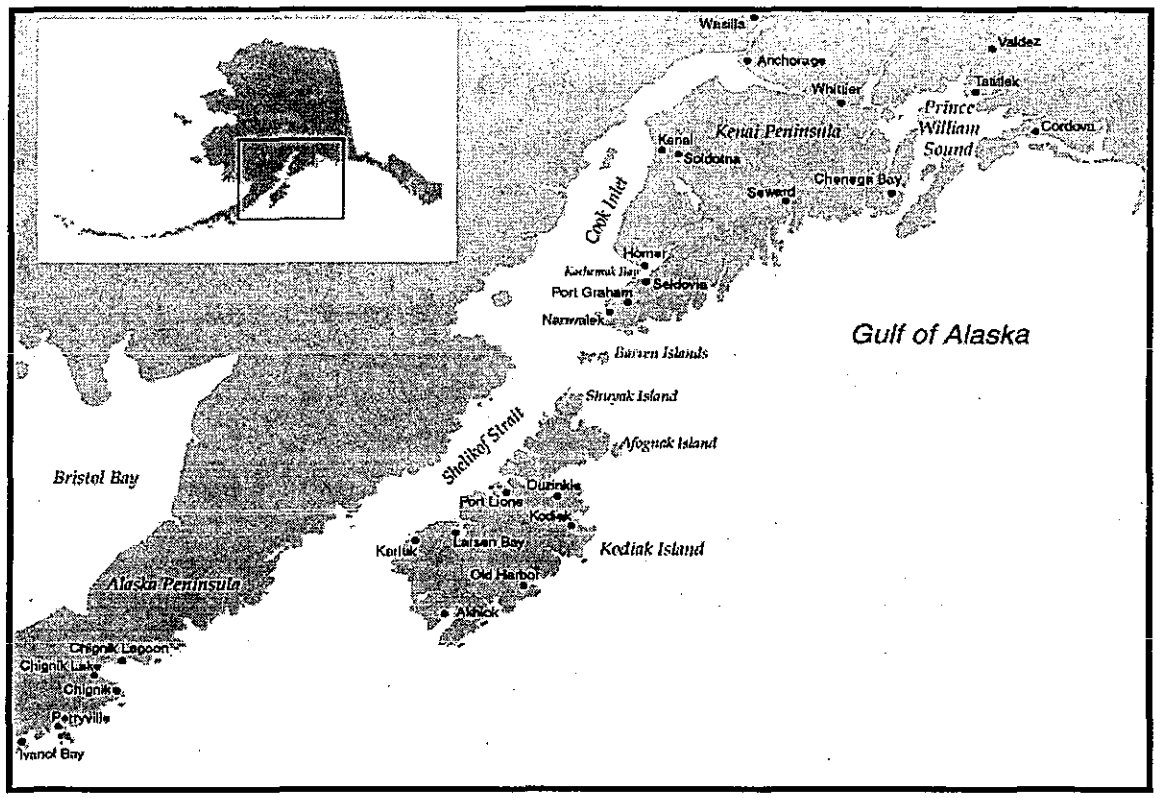

Figure 1.1 Map of the spill area showing the location of communities

The primary geographic focus of GEM will be the four habitat types that contain the ecosystems of the northern GOA. These habitats are the watersheds, intertidal and subtidal, Alaska Coastal Current (ACC), and offshore (the continental shelf break and the Alaska Gyre).

Although GEM has a regional outlook, the waters of the GOA are connected to adjacent waters. Waters from the shelf and basin of the GOA eventually enter the Bering Sea and the Arctic Ocean through the Bering Strait. Waters from the west coast states (California, Oregon, and Washington), Canada and southern Alaska also feed into the northern GOA. Consequently, the program will be of vital importance in understanding the downstream Bering Sea and Arctic Ocean ecosystems, as well as the upstream southern GOA. In addition to the linkages

provided by the movements of ocean waters, the GOA is linked to other regions by the many species of birds, fish, and mammals that move through these regions. It is also becoming increasingly clear that environmental conditions in the GOA, such as levels of persistent organic pollutants, as well as the temperature of GOA waters, can originate many thousands of miles away.

The Trustee Council is aware of the trade-offs between the size of the area to be studied and the frequency and intensity of the monitoring and research that can be conducted there. In selecting core variables for long-term research and monitoring, the GEM Program will need to ensure that measurements are conducted at the spatial and temporal scales necessary to achieve the desired goals of the program. For this reason, much thought must be given to the selection of the variables and the identification of the subset of the northern GOA that can reasonably be monitored by a program the size of GEM. It is anticipated that partnering with other agencies and programs will help extend the GEM research area beyond that which GEM could fund on its own. However, because of its critical importance to meeting the program's goals and objectives, core monitoring based on a set of core variables will be fully supported by the GEM program.

1.5 Funding and Governance

The Trustee Council will fund the GEM program beginning in October 2002 with funds allocated for long-term monitoring and research, estimated to be approximately $120 million. The Trustee Council will manage these funds as an endowment, with the annual program funded by investment earnings after inflation-proofing, thus providing for a stable program through time. The Trustee Council may choose to fund a smaller program in the early years to allow the corpus of the fund to build. The Trustee Council's long-term goal is to allow for additional deposits and donations to the fund from other sources to increase the corpus. Achieving this goal might require changes in state or federal legislation and possibly a change in the court-approved settlement and will be pursued at a later time.

Under existing law and court orders, three state and three federal trustees have been designated by the Governor of Alaska and the President of the United States to administer the restoration fund, which includes funding for GEM, and to restore the resources and services injured by the oil spill. The State of Alaska trustees are the Commissioner of the Alaska Department of Environmental Conservation, the Commissioner of the Alaska Department of Fish and Game, and the Attorney General. The federal trustees are the Secretary of the Interior, the Secretary of Agriculture, and the Administrator of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

The trustees established the Trustee Council to administer the restoration fund. The state trustees serve directly on the Trustee Council. The federal trustees each have appointed a representative in Alaska to serve on the Trustee Council. The representatives currently are the Senior Advisor to the Secretary for Alaskan Affairs (Department of the Interior), the Alaska Director of the National Marine

Fisheries Service (National Oceanic and Atmospheric Administration), and the Supervisor of the Chugach National Forest (U.S. Department of Agriculture). All decisions by the Trustee Council are required to be unanimous.

It is expected that the current Trustee Council will make policy and funding decisions for the GEM program. It has been suggested that at some time in the future, a new board or oversight structure other than the Trustee Council be established to administer or guide the GEM fund. It is also possible that an existing board, either under its current structure or with minor modifications, could take over management of the fund. Use of a new governance structure, if justified, would require changes in law and the applicable court decrees. Such changes would take considerable time and are not anticipated in the near future.

1.6 Building on Lessons of the Past

The GEM program is not the first attempt to look at large areas of Alaska's marine ecosystems from a broader perspective. The *Exxon Valdez* Oil Spill Restoration Program, as well as a number of other programs, provides valuable guidance. This section briefly describes some of these programs and their relevance to the development of GEM.

1.6.1 Alaska Regional Marine Research Plan (1993)

The *Alaska Regional Marine Research Plan* (ARMRP) (1993) is a marine science planning document with a broad geographic scope that was prepared under the U.S. Regional Marine Research Act of 1991. ARMRP goals express the scientific needs of the Alaska region as of 1992 and are still relevant to the GEM effort:

- Distinguish between natural and human-induced changes in marine ecosystems of the Alaska region;
- Distinguish between natural and human-induced changes in water quality of the Alaska region;
- Stimulate the development of a data gathering and sharing system that will serve scientists in the region from government, academia, and the private sector in dealing with water quality and ecosystem health issues; and
- Provide a forum for enhancing and maintaining broad discussion among the marine scientific community on the most direct and effective way to understand and address issues related to maintaining the health of the water quality and ecosystem health in the region.

Goals of other major programs are relevant to the GEM effort.

1.6.2 Bering Sea Ecosystem Research Plan (1998)

The Bering Sea has received considerable attention because of concern about long-term declines in populations of high-profile species such as king and tanner crab, Steller sea lions, spectacled eiders, Steller's eiders, common murres, thick-

billed murres, and red-legged and black-legged kittiwakes (DOI et al. 1998b). The GEM mission is consistent with the vision of the federal-state regulatory agencies for the *Bering Sea Ecosystem Research Plan* (DOI et al. 1998a), which states: "We envision a productive, ecologically diverse Bering Sea ecosystem that will provide long-term, sustained benefits to local communities and the nation." The basic concepts of the GEM program are also consistent with the overarching hypotheses of the Bering Sea plan.

1.6.3 GLOBEC (1991 to Present)

The Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission (IOC) established the Global Ocean Ecosystem Dynamics (GLOBEC) program in late 1991. GLOBEC is the core project of the International Geosphere-Biosphere Programme responsible for understanding how global change will affect abundance, diversity, and productivity of marine populations. The program focuses on the regulatory control of zooplankton dynamics on the biomass of many fish and shellfish.

The GLOBEC Science Plan (U.S. GLOBEC 1997) describes an approach that uses a combination of field observations and modeling to concentrate on the middle and upper trophic levels of the ecosystem. The overarching concept is that marine and terrestrial ecosystems have close connections among energy flow, chemical cycling, and food web structure. GEM monitoring activities will be consistent with GLOBEC concepts.

1.6.4 Scientific Legacy of the *Exxon Valdez* Oil Spill (1989 to Present)

Ecological knowledge gained in the years following the 1989 *Exxon Valdez* Oil Spill (EVOS) forms a substantial portion of the foundation of the GEM program. In 1994 the *Exxon Valdez* Oil Spill Restoration Plan was adopted to guide the development and implementation of a comprehensive, interdisciplinary recovery and rehabilitation program. The recovery status of each affected resource is based to the extent possible on knowledge of the resource's role in the ecosystem. The scientific legacy of the *Exxon Valdez* Oil Spill Trustee Council (Trustee Council) creates the need to understand the causes of population trends in individual species of plants and animals through time and the need to distinguish human impacts from those of climate and interactions with related species.

The studies supported by the Trustee Council since 1989 include more than 1,600 damage assessment studies costing more than $100 million, as well as hundreds of restoration studies costing approximately $170 million. These studies have resulted in more than 500 peer-reviewed scientific publications, including numerous dissertations and theses. In addition, hundreds of peer-reviewed project reports are available through the Alaska Resources Library and Information Services (ARLIS) and state and university library systems. Many final reports are available in electronic format through the Trustee Council offices or ARLIS. A current electronic bibliography of scientific publications sponsored by the Trustee

Council is available on its Web site (www.oilspill.state.ak.us) or on request to the Trustee Council (EVROTCB 2002). A list of Trustee Council projects, as well as a complete list of final and annual project reports, also is available on the Web site or on request (EVROFAB 2002).

In addition to much specific information on the effects of oil on the plant and animal life in the spill area, the studies also provide a wealth of ecological information. Most prominent among the Trustee Council's studies are three ecosystem-scale projects, known by their acronyms: SEA, NVP, and APEX.

The Sound Ecosystem Assessment (SEA) is the largest of the three studies. Funded at $22 million for a seven-year period. SEA brought together a team of scientists from many different disciplines to understand the biological and physical factors responsible for producing herring and salmon in PWS. The data collected during SEA are expected to form the basis of numerical models capable of simulating the oceanographic processes that influence the survival and productivity of juvenile pink salmon and herring in PWS. SEA has already provided new insights into the critical factors that influence fisheries production, including ocean currents, nutrient levels, mixing of water masses, salinity, and temperatures. These observations have made it possible to model how physical factors influence production of plant and animal plankton, prey, and predators in the food web.

The Nearshore Vertebrate Predator (NVP) project is a six-year, $6.5 million study of factors limiting recovery of two fish-eating species, river otters and pigeon guillemots, and two invertebrate-eating species that inhabit nearshore areas, harlequin ducks and sea otters. The project looked at oil exposure, as well as natural factors such as food availability, as potential factors in the recovery of these indicator species, and has contributed to increased understanding of the linkages between terrestrial and marine ecosystems.

The Alaska Predator Ecosystem Experiment (APEX) is an eight-year, $10.8 million study of ecological relations among seabirds and their prey species. The APEX project explored the critical connection between productivities of marine bird populations and forage fish species, in an attempt to understand how wide-ranging ecological changes might be related to fluctuating seabird populations. In addition, analyzing the food of marine birds shows promise in providing abundance estimates for key fish species, such as sand lance and herring.

The following topics also have been covered by other Trustee Council-funded studies and the results are available in published scientific literature:

- Physical and biological oceanography;
- Marine food web structure and dynamics;
- Predator-prey relationships among birds, fish, and mammals;
- The source and fate of carbon among species;

- Developmental changes in trophic level within species;
- Marine growth and survival of salmon;
- Intertidal community ecology; and
- Early life history and stock structure in herring.

Many studies have focused on key individual species injured by the oil spill, including pink and sockeye salmon, cutthroat trout, Pacific herring, black oystercatchers, river otters, harbor seals, mussels, and kelp.

One of the most extensive series of single-species investigations is the $14 million suite of pink salmon studies. These include monitoring the toxic effect of oil, conducting genetic studies related to survival, and supplementing select populations. Another extensive series of studies was done on Pacific herring. Roughly $6 million has been spent on the restoration of Pacific herring in addition to the funding for the herring component of SEA. Since the crash of 1993, the population has yet to recruit a highly successful post-spill year-class. Current investigative strategies are focused on the full range of causes of the crash, such as disease and ecological factors, including the effects of oceanographic processes on year-class strength and adult distribution and understanding stock structure.

More than $6 million has been spent on the restoration of marine mammals, primarily harbor seals, a major source of subsistence food in the diet of Native Alaskans in the northern GOA. Harbor seal populations were declining before the spill, took a big hit at the time of the spill event, and have continued to decline ever since, although the rate of decline seems to have slowed. Food availability is the major focus of current research, because disease and other factors have been ruled out as causes.

1.6.5 Trustee Council Commitment to Traditional Knowledge and Community Involvement

From 1995 –2002, the Trustee Council provided almost $2 million to the Chugach Regional Resources Commission to facilitate the involvement of local communities in the oil spill restoration program and improve communication between spill area residents, community councils, regional organizations, scientists and the tribal community. The facilitators and coordinators have been active participants in all the GEM planning workshops and meetings. This project has also funded the development of natural resource management plans in several villages, which tribal representatives believe are a necessary step before incorporating tribal concerns into the GEM program.

This long-term project (1995-2002) was designed to:

- Increase meaningful involvement of spill area communities in the Trustee Council restoration efforts/process

- Provide **information** to communities regarding data and scientific research performed by the Trustee Council science program
- Improve **communication** of findings and results of restoration efforts to spill area residents, village councils, and the appropriate regional organizations
- Promote the **inclusion of community-based projects**, as well as community involvement in science projects throughout the life of the restoration effort.
- Work with the **formation of local natural resource management programs** that will focus on the stewardship and management of injured resources and lands
- Develop a means to compile and utilize **western science and traditional wisdom** in a cooperative manner to further the restoration process in ways that are sensitive to the needs of the communities

The Chugach Regional Resources Commission coordinated this project by employing community facilitators in 10 communities, and a spill area-wide community involvement coordinator who facilitated communication between the communities, theTrustee Council, and scientists.

Also since 1995, the Trustee Council has funded Youth Area Watch programs through the Chugach School District and Kodiak Island Borough School District. These programs involve youth from local spill area communities in the science behind the restoration effort. As of 2002, 168 students have participated in the Prince William Sound and Kodiak programs with students participating in such projects as harbor seal biosampling, seabird momitoring, collection oceanographic data on cruises, and analyzing chemicals found in intertidal mussels.

In 1994 the Trustee Council received its first call from a community resident to incorporate Traditional Ecological Knowledge (TEK) of spill area residents into the restoration program. Two years later, the Trustee Council's 1996 annual restoration workshop had TEK as its theme, and led to a set of protocols for incorporating TEK into restoration projects developed by a committee of Alaska Natives and others and approved later that year by the Trustee Council. The Trustee Council has provided funds each year since 1995 toward the goal of incorporating TEK into the restoration program. Efforts have included:

- Developing a TEK handbook and reference guide for biologists documenting the sources of TEK in the spill area and incorporating it into a western science approach.
- Providing funds for Chugach Regional Resource Commission (CRRC) to contract with TEK expert Henry Huntington for seven years. He has worked directly with Alaska Native elders and hunters as well as scientists

to bridge the gap between these two different approaches to understanding the natural world. A result of this process is that several EVOS projects incorporate TEK directly into their data sets and results, including projects on community natural resource management, fish and seabird studies, and a series of films about Alutiiq culture (see examples below).

- Conducting two workshops to develop tribal management programs and bringing several scientists to spill area communities to share information.

Examples of projects incorporating TEK as a result of Trustee Council efforts include:

- Scientist Jody Seitz conducted an extensive project involving TEK. Researchers interviewed thirty-nine spill area community members to document the historical distribution of forage fish such as juvenile herring, sand lance, capelin, and eulachon. This information was mapped and provided to the Alaska Predator Ecosystem Experiment (APEX) and Sound Ecosystem Assessment (SEA) researchers. The results were extremely valuable because they could not have been obtained from other historical sources or from current data collection efforts.

- Scientist Dan Rosenberg solicited local participation from communities and conveyed results of his research on surf scoters, an important subsistence resource. The project idea came from local communities. Rosenberg worked with community members throughout all stages of the project, from project design to writing the final report.

- The Trustee Council provided funding support to the Alaska Native Harbor Seal Commission, which uses Alaska Native hunters to conduct biosampling of harbor seal tissues using lab-approved techniques. In 1999, the commission reached an agreement with the National Marine Fisheries Service to co-manage harbor seal populations.

- Three videos have been produced with Trustee Council funds to provide the public information about TEK and concerns about subsistence use after the oil spill. The first two, *Alutiiq Pride: A Story of Subsistence* and *Changing Tides in Tatitlek* describe subsistence methods, interview Alaska Native people who experienced the spill first hand, show actual subsistence hunts, and illustrate the importance of subsistence in Alutiiq culture. The third documents the communities of Chenega Bay and Ouzinkie in relation to the effects of the oil spill, residual oil in the spill region, and concerns about paralytic shellfish poisoning (PSP) toxins, natural toxins found in clams harvested for food. These videos were distributed at no charge to all schools in Alaska via their school districts, all spill area tribal councils, and any other library or school in the U.S. upon request.

The Trustee Council funded Elders/Youth Conferences in 1995 and 1998 that brought together Alaska Native elders, youth, other subsistence users, scientists,

and managers to share ideas about subsistence issues and facilitate community involvement. The Trustee Council paid for four people from each of 20 spill area communities to attend each conference. Participants shared stories, voiced frustration, and asked scientists questions about subsistence issues. They also developed ideas for youth to get more involved through spirit camps, internships, and educational opportunities. These workshops facilitated collaboration between communities of the spill area, while concerns and ideas generated at the conference were reported to the Trustee Council.

Additional details on the Trustee Council's tribal and community involvement efforts are included in a report in Appendix C.

1.7 References

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2. CONCEPTUAL FOUNDATION AND CENTRAL HYPOTHESIS

In This Chapter

- Conceptual Foundation
- Central Hypothesis
- Habitat Types and Time-Space Scales
- Central Hypothesis by Habitat Type

2.1 Introduction to the GEM Conceptual Foundation

The intellectual framework of the GEM program is a hierarchy composed of a conceptual foundation, central hypothesis, habitat-specific hypotheses, research questions, and ultimately, testable hypotheses based on the specific questions (Figure 2.1). Four habitat-specific key hypotheses, based on the central hypothesis, form the core of the GEM monitoring plan. The conceptual foundation provides an overarching explanation, or verbal model, of how the GOA ecosystems produce biological resources. As such, the conceptual foundation is not itself a testable hypothesis on the sources of change in ecosystems, but rather, the origin of hypotheses, both general and testable. Habitat-specific hypotheses are based on assumptions about how natural and anthropogenic factors influence ecosystem functioning within each of the habitat types, recognizing that different factors may be important in different habitats. This chapter presents the narrative of the GEM conceptual foundation for the GOA, addresses cross-habitat connections and regional variability, and adapts the narrative of the conceptual foundation to describe the four habitat types used by GEM.

2.1.1 The GOA at a Glance

The conceptual foundation for the GOA ecosystem explains how its plant and animal populations are controlled through time. A broad, interdisciplinary conceptual foundation serves as a flexible framework for determining the type of monitoring and research activities that will be undertaken in implementing the GEM program. The conceptual foundation is the product of syntheses of the latest scientific information and an assessment of leading ecological hypotheses. It encapsulates the Trustee Council's understanding of how the GOA operates as an ecological system and how its biological resources, including highly valued populations of animals, are regulated.

The conceptual foundation focuses on how the marine ecosystem in the GOA works.

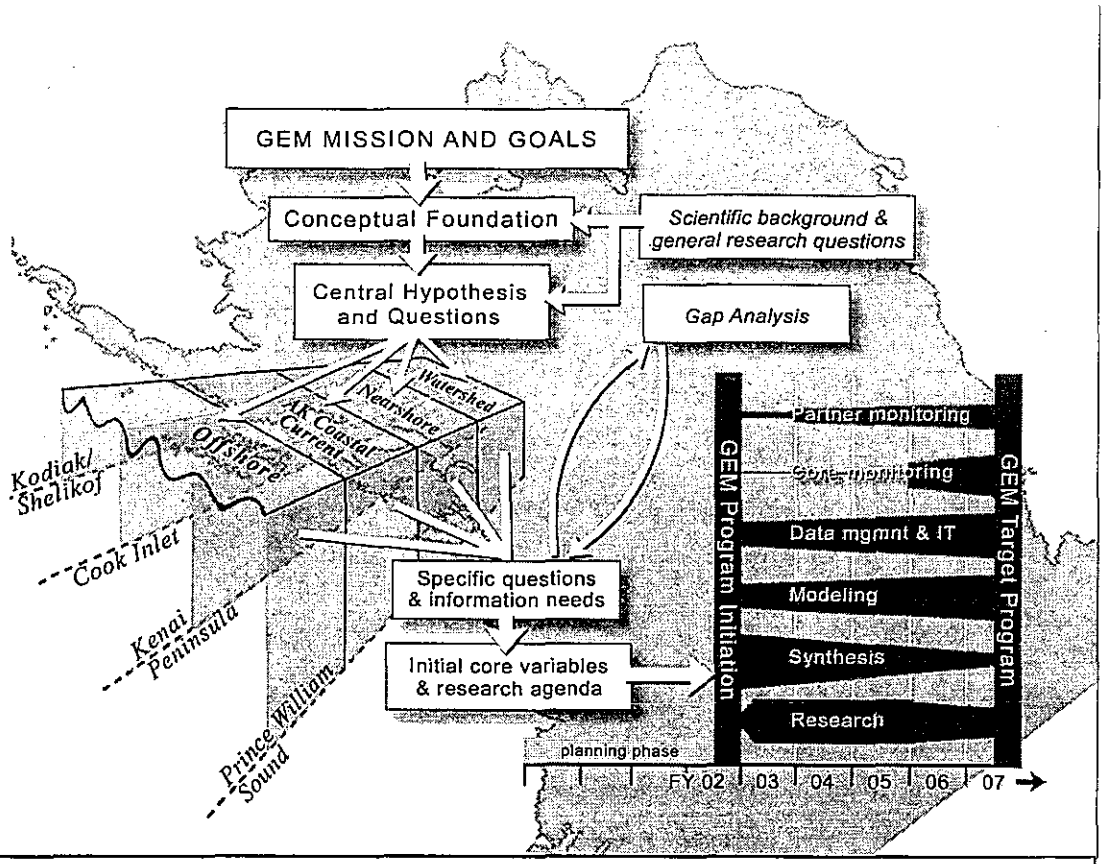

Figure 2.1. Overview of the GEM program structure showing the relation of key concepts to the habitat types, implementation tools, and the schedule of implementation.

Specific citations to the scientific literature are omitted for the sake of brevity, however these may be found in the scientific synthesis of Chapter 7. Taking the watersheds and marine areas of the GOA together at a single glance, the importance of key geological features in shaping the natural physical and biological forces that control productivity is apparent (Figure 2.2). Note that features illustrated in Figure 2.2 are printed in bold in the following text. Natural forces are shaped by the surface topography of the Gulf. Storm tracks moving across the North Pacific from west to east can drive **Aleutian Low Pressure (ALP)** systems deep into the GOA until the encounter with **boundary mountains** causes the release of **precipitation** and **airborne contaminants. Freshwater runoff** strengthens the **Alaska Coastal Current (ACC)** even as it brings airborne and terrestrial pollutants into the **watersheds** and **food webs.**

Natural forces that control biological productivity are also shaped by the submarine topography (bathymetry) of the **continental shelf.** Deep waters **upwell** across the **continental shelf break,** subsequently being carried across the **photic boundary** into areas of photosynthetic activity by the motion of surface currents, **(Alaska Coastal Current, ACC; Alaska Current, AC), lunar forcing,** the motion of the earth, and **tidal mixing.** These deep waters carry **old carbon and nutrients** up into the food webs of the shelf and onshore areas. Where the deep waters

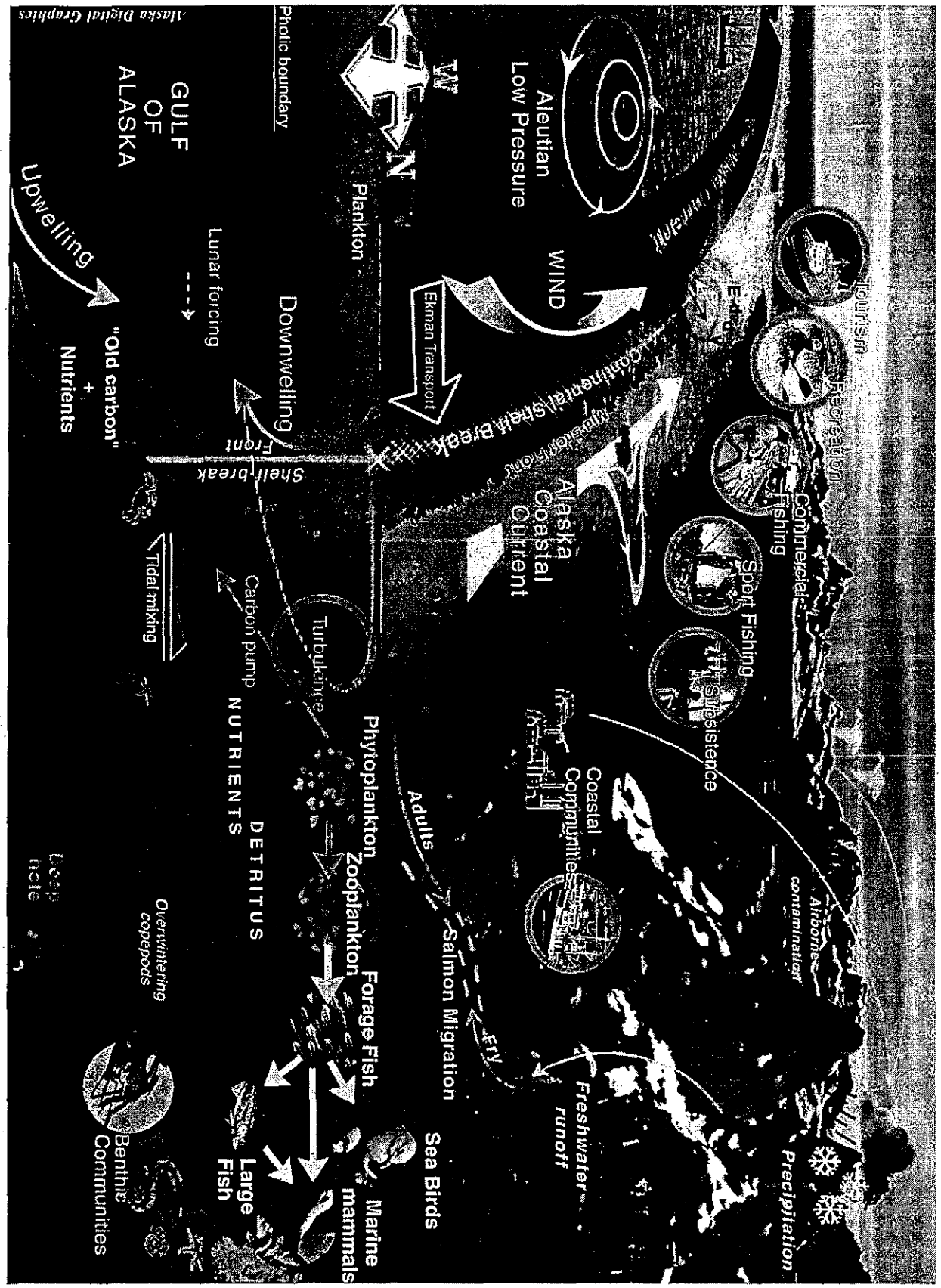

Figure 2.2 The physical and biological elements of the ecosystems of the northern GOA from the mountains surrounding the watersheds to the oceanic waters offshore.

encounter islands, seamounts and sills, the resulting currents may deform the boundaries of the frontal zones of the ACC (**mid-shelf front**) and AC (**shelf-break front**), creating **eddies** that entrain plankton and other plants and animals for long periods of time.

Natural physical forces control productivity by limiting the amount of food and availability of habitats. During the winter especially, the ALP produces **wind-driven transport** of surface marine waters (**Ekman transport**), bringing water onshore. Movement of water onshore creates **downwelling** that takes plankton and associated nutrients out of the photic zone. On the other hand, the wind may act to hold the nutrients dissolved in water and held in **detritus** in the photic zone in some areas, because wind also produces **turbulence** that mixes the surface water. Turbulent mixing causes nutrients to be retained in surface waters, and retention increases production of **phytoplankton**, the base of the food web in surface waters. Production of **zooplankton**, secondary productivity, is the trophic connection (linkage) of phytoplankton to production of **forage fish**, which in turn links primary productivity to **seabirds, large fish, marine mammals,** and **benthic and intertidal communities.**

The biogeochemical cycle is an important collection of natural biological and physical processes controlling the productivities of both marine and terrestrial environments. The mechanisms that move carbon from the surface to the deep waters, are known collectively as the **carbon pump.** Atmospheric carbon moves into seawater as carbon dioxide to be incorporated by phytoplankton during photosynthesis. Carbon also enters the sea as carbonates leached from the land by freshwater runoff, as plant debris, and as other biological input, such as immigrations of salmon (**salmon fry**) and other anadromous species. Carbon moves to benthic communities and to deep water as detritus and emigrant animals (**overwintering copepods** and migrating fish such as myctophids). Emigrant animals (**adult salmon** and other anadromous species) also move marine carbon (and phosphorous and nitrogen) into the watersheds.

As illustrated by the interactions of biological and physical components of the biogeochemical cycle, natural biological forces modify the effects of natural physical forces on birds, fish, and mammals. Because of biological-physical interactions, natural physical forces that cause changes in **primary productivity** do not necessarily cause proportional changes in populations of birds, fish, mammals, and benthic animals. For example, the effects of physical forces on the amount of food available from primary productivity are modified through other natural forces, such as **predation and competition** among individuals, collectively known as the **trophic linkages.** Populations that respond strongly to physical forcing of primary productivity on approximately the same time scales are termed "strongly coupled," and those that exhibit variable responses are termed "weakly coupled" with respect to those physical variables. Note that physical forcing changes not only the food available from primary productivity, but also the extent of habitats available for reproduction and feeding.

Human actions also serve to change the ways in which populations of plants and animals respond to the natural physical forces that affect the responses of reproduction, growth, and survival through limiting food and habitat. Human actions such as water withdrawals, sewage discharge, and development of **coastal communities** change productivity by altering habitat availability and trophic linkages. The economy of Alaska depends heavily on extraction of natural resources (primarily oil, fish, and shellfish followed by timber and minerals). Fishing and other extractive uses (**subsistence, sport, commercial**) affect death rates through removals. Other forms of human action are more subtle, but no less effective, controls on productivity. In the Northern Gulf of Alaska, recreation and tourism, oil and gas development, logging, road building and urbanization, marine transportation and subsistence harvests are all activities that have the potential to affect fish and wildlife populations and habitat. **Recreation and tourism** may alter growth and reproduction by disturbing rookeries and introducing pollutants. **Commercial marine transport** may alter productivity by introducing pollutants (oil spills) and noxious exotic species as competitors and predators. Currently, the human impact on Alaska's marine ecosystems is relatively small compared to impacts in most of the developed world. Even here, however, natural resource managers have concerns about localized pollution, the potential impacts of some fisheries, extreme changes in some fish and wildlife populations, and the little known impacts of contaminants and global warming.

In summary, Figure 2.2 shows that the GOA and its watersheds are part of a larger oceanic ecosystem in which natural physical forces such as currents, upwelling, downwelling, precipitation and runoff, acting over large and small distances, play important roles in determining basic biological productivity. Natural physical forces respond primarily to seasonal shifts in the weather, and in particular to long-term changes in the intensity and location of the ALP system in winter. Increased upwelling offshore appears to increase inputs of nutrients to surface waters, which increases productivity of plankton. Increased winds appear to increase the transport of zooplankton shoreward toward and past the shelf-break. How often and how much offshore zooplankton sources contribute to coastal food webs depends on natural physical and biological forces such as predation, migration, currents and structure of the fronts, formation and stability of eddies, degree and extent of turbulence, and responses of plankton to short and long-term changes in temperature and salinity.

A wide range of human impacts interacts with natural biological and physical forces to change productivity and community structure in the GOA. Approximately 71,000 full-time residents live within the area directly affected by the oil spill and two to three times that number use the area seasonally for work and recreation. The spill area population, combined with that of the nearby population centers of Anchorage and Wasilla, totals more than 60% of the state's 627,000 permanent residents. When the resident population is combined with the more than one million tourists who visit the state each year, it becomes clear that the natural resources of the GOA cannot be immune to the pressures associated

with human uses and activities. Human activities have the most direct and obvious impacts at those sites in watersheds and intertidal areas where human populations are high. Nonetheless, some human activities affect populations of birds, fish, shellfish, and mammals far offshore, and also have impacts far from the sites of the actions. In short, human activities and natural forces together act over global to local scales to drive and shape marine and terrestrial life in the GOA and its tributary watersheds. Natural forces and human impacts, as exemplified by heat and salt distribution, insolation, biological energy flow, biogeochemical cycling and food web structure, fishery removals, pollutant inputs, and the relationships among them over time define the state of the marine ecosystem. Natural forces and human impacts bring about changes in populations of birds, fish, shellfish, and mammals by altering the relationships among these state variables that define the marine ecosystem.

Because of the tremendous uncertainty about sources of long-term changes, the conceptual foundation does not provide a specific model (testable hypothesis) for ecosystem change. Rather, the GEM conceptual foundation is designed to be broad enough to serve as a tool to organize thinking and research over long time periods, to encompass ecosystem interconnections, and to link information from traditional knowledge and scientific disciplines. It takes into account both oceanic and terrestrial ecosystems and addresses the influence of climate and human activity in influencing biological productivity within these interconnected systems. By using this broad, scientifically grounded conceptual foundation, the GEM program will be able to adapt to changes in understanding ecosystem processes without having to sacrifice long-term research and monitoring goals (NRC 2002).

The GEM program will, however, need to develop specific testable hypotheses, as derived from a general, or central hypothesis, in order to implement the monitoring and research program. As a start on a central hypothesis, consider the one provided by the NRC (2002, p. 27), as follows,

> ***The Gulf of Alaska, its surrounding watersheds, and human populations are an interconnected set of ecosystems that must be studied and monitored as an integrated whole. Within this interconnected set, at time scales of years to decades, climate and human impacts are the two most important driving forces in determining primary production and its transfer to upper trophic-level organisms of concern to humans.***

The NRC summary identifies climate and human impacts as the two most important determinants of biological production, among the many forcing factors recognized as significant in the conceptual foundation. Nonetheless, the biological communities that support the birds, fish and mammals are subject to a variety of biological and physical agents and factors of change, any one of which can at times play an important, and even dominant, role in controlling populations of birds, fish, shellfish and mammals. A formal statement of the central hypothesis that starts with and considers the full suite of forcing factors is needed to allow

research and monitoring to identify the most important forcing factors for species and habitats of the GEM region.

2.2 The Central Hypothesis and Habitat Types

Identifying the forcing factors, human and natural, that drive biological production requires framing hypotheses and questions that point the way for a scientific monitoring and research program. The central hypothesis formally states widely held beliefs about what drives changes in living marine-related resources in time and space:

> *Natural forces and human activities working over global to local scales bring about short term and long lasting changes in the biological communities that support birds, fish, shellfish and mammals. Natural forces and human activities bring about change by altering relationships among defining characteristics of habitats and ecosystems such as heat and salt distribution, insolation, biological energy flow, freshwater flow, biogeochemical cycles, food web structure, fishery impacts, and pollutant levels.*

Although widely accepted as fact, the specific mechanisms that cause change are largely untested in the GEM region, and the relative importance of the forcing factors is unknown. Current speculations, supported by limited observations, are that forcing by winds, precipitation, predation, currents, natural competitors for food and habitat, fisheries, and pollutants change living marine-related resources over different scales of time and space through alteration of critical properties of habitats and ecosystems (Figures 2.3 and 2.4).

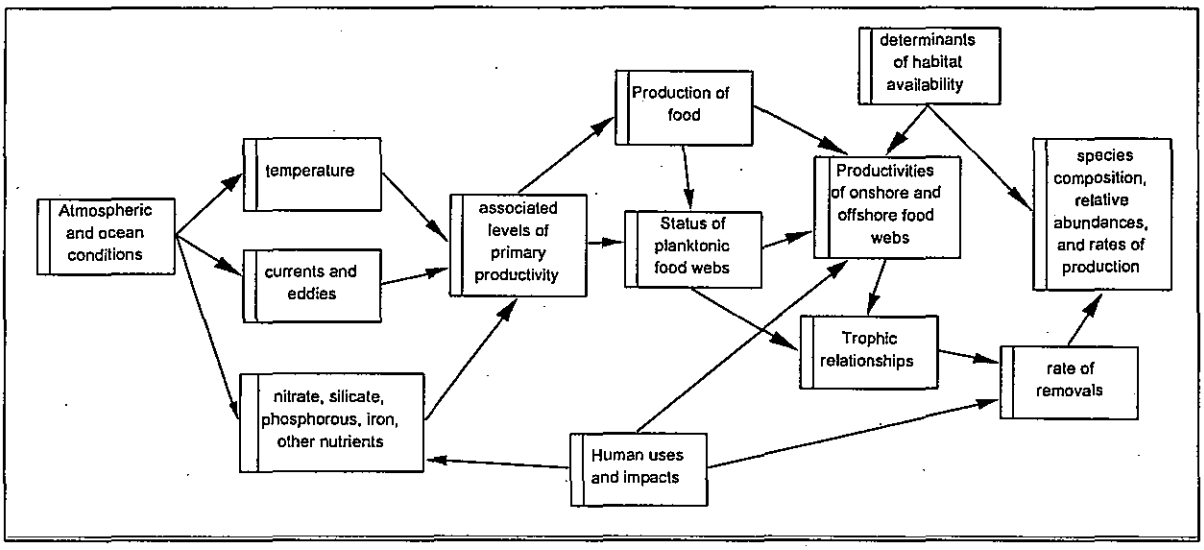

Figure 2.3 Possible connections among specific mechanisms and agents of change in living marine-related resources.

Although the central hypothesis may appear to be a bland statement of the obvious, it is an essential first step in applying the scientific method to address the many open, and sometimes highly contentious, scientific questions about whether, and to what extent, human activities are responsible for degradation of habitats declines in populations of animals. The central hypothesis states what is thought to be known in general, preparing the way for questions that test the validity of this knowledge. For example it is reasonable to ask of the central hypothesis, "What are the natural forces and are they equally important in all types of habitat?" Critically examining the starting point through posing and answering questions, is intended to point out the need for more specific hypotheses, which in turn lead to more specific questions, and so forth.

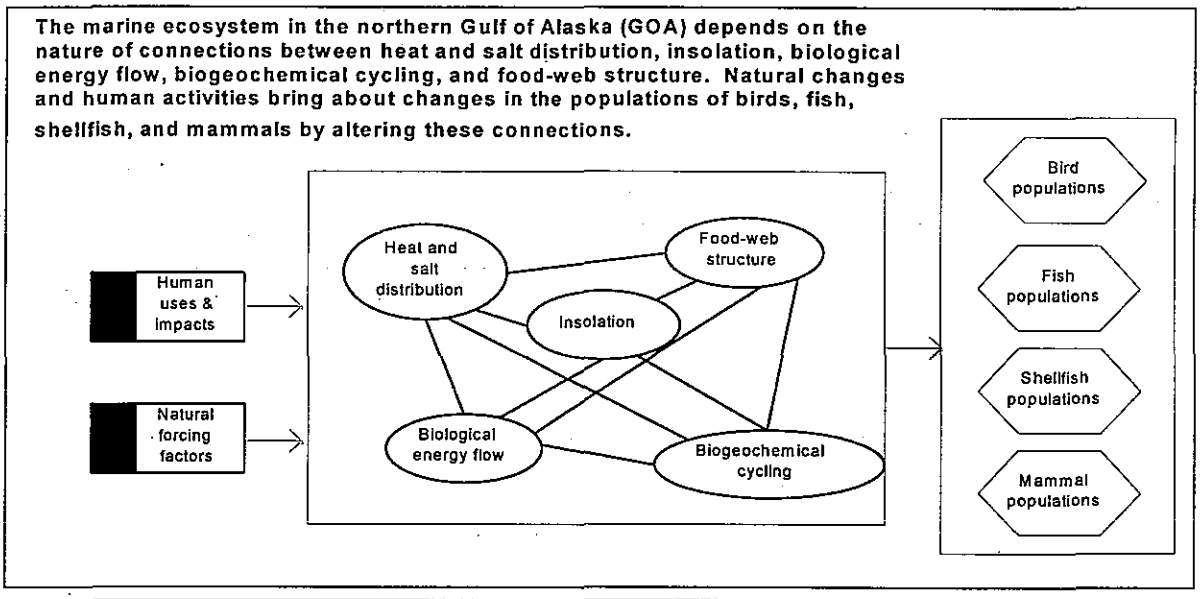

Figure 2.4 Relations among major parts of the GEM conceptual foundation.

The central hypothesis is given more specificity through adaptation to habitat types in the following section. Before adding specificity to the central hypothesis, the habitat types need definition, and the context of conducting studies at time-space scales appropriate to the phenomenon needs to be provided.

To better organize the GEM program, four habitat types, representative of the GEM region, have been identified as themes around which the interdisciplinary monitoring and research activities that address GEM's central hypothesis will be organized. These habitat types are: watersheds, the intertidal and subtidal areas, the ACC, and the offshore areas (the continental shelf break and the Alaska Gyre). These habitats were selected after evaluating information about how natural forces and human activities control biological productivity in the northern GOA (Chapters 6 and 7). The habitats are composed of identifiable, although not rigid, collections of characteristic microhabitats, resident and migratory species, and physical features. The physical locations are described below:

- Watersheds—freshwater and terrestrial habitats from the mountains to the extent of a river's plume.
- Intertidal and subtidal areas—brackish and salt-water coastal habitats that extend offshore to the 20-m depth contour.
- ACC—a swift coastal current of lower salinities (25 to 31 psu) typically found within 35 km of the shore.
- Offshore—the continental shelf break (between the 200-m and 1,000-m depth contours) and the Alaska Gyre in waters outside the 1,000-m depth contour.

The decision to use habitats as a mechanism for stratifying funds and allocating resources will require the GEM program to ensure that cross-habitat processes and transfers are not forgotten or ignored. Having an appreciation for the scales of time and space over which the processes responsible for biological production occur is essential for designing monitoring and research intended to detect and understand changes in the ecosystem (Figure 2.5). To understand the composition and extent of ecosystems, it is necessary to ask and answer questions about the distances and time associated with the variation in the biological and physical phenomena. As stated eloquently by Ricklefs (1990, p. 169), "Every phenomenon, regardless of its scale in space and time, includes finer scale processes and patterns and is embedded in a matrix of processes and patterns having larger dimensions." Indeed, spatial and temporal scales are part of the

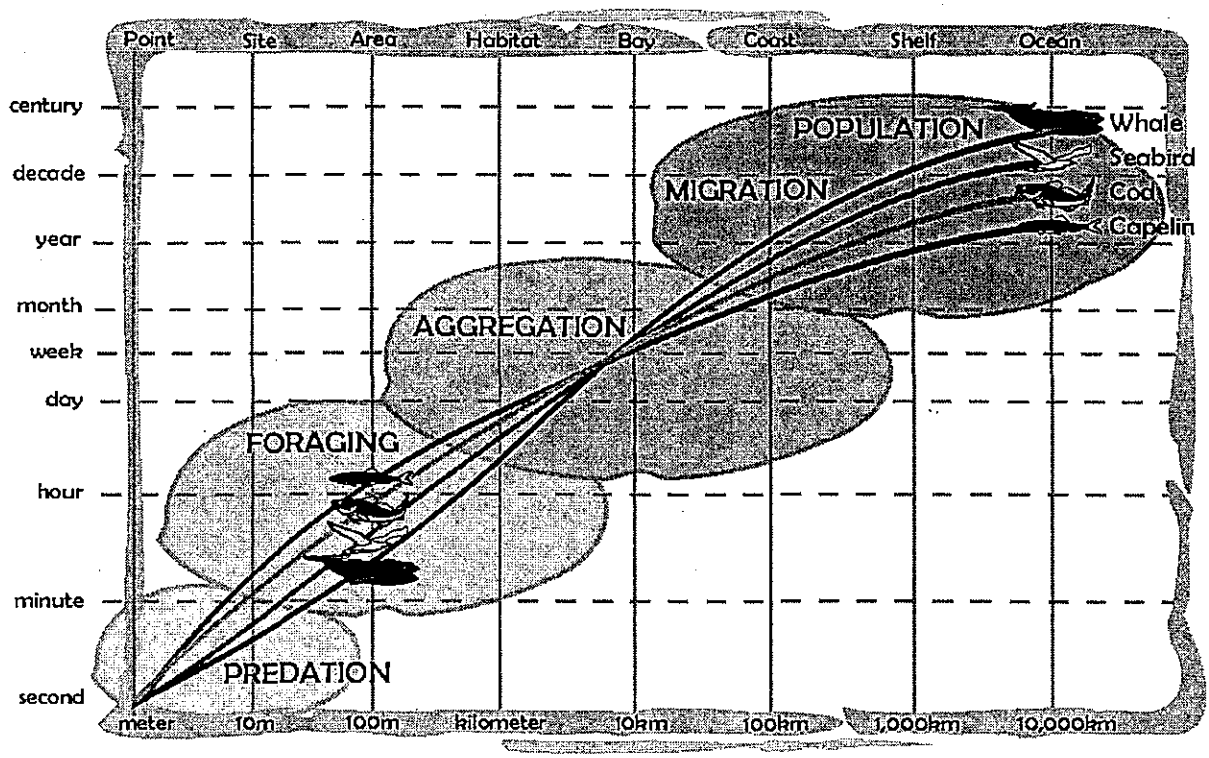

Figure 2.5 Scales of time and space corresponding to key elements and processes in ecosystems of the GOA. Illustration provided by John Piatt.

definitions of physical and biological processes such as advection and growth. Taking account of spatial and temporal scales is critical to studying linkages between natural forces and biological responses (Francis et al. 1998).

Cross-habitat linkages and processes will be incorporated into the GEM program in several ways that will be described in more detail in later chapters. The primary mechanisms for ensuring they are addressed will be through ongoing synthesis of research results and oversight by the Scientific and Technical Advisory Committee. It is also expected that modeling efforts will be regional in focus rather than habitat specific.

2.2.1 Central Hypothesis by Habitat Type

The central hypothesis is adapted to each habitat type:

Watersheds:

Natural forces (such as climate) and human activities (such as habitat degradation and fishing) serve as distant and local factors in causing short-term and long-lasting changes in marine-related biological production in watersheds.

Intertidal and Subtidal:

Natural forces (such as currents and predation) and human activities (such as increased urbanization and localized pollution) serve as distant and local factors, in causing short-term and long-lasting changes in community structure and dynamics of the intertidal and subtidal habitats.

Alaska Coastal Current (ACC):

Natural forces (such as variability in the strength, structure and dynamics of the ACC) and human activities (such as fishing and pollution) cause local and distant changes in production of phytoplankton, zooplankton, birds, fish, and mammals.

Offshore:

Natural forces (such as changes in the strength of the Alaska Current and Alaskan Stream, mixed layer depth of the gyre, wind stress and downwelling) and human activities (such as pollution) play significant roles in determining production of carbon and its shoreward transport.

As noted above, these hypotheses can be used as a general guide to monitoring and research, but they need to be further refined into questions which identify a core set of measurements for implementation of long-term monitoring and research. In Chapter 4 the habitat-type hypotheses are examined through specific questions that lead to preliminary recommendations on what information needs to be gathered, as a starting point for the GEM program. Basic definitions of the tools

for implementing the program, as provided in Chapter 3, are needed before launching into the details of implementation found in Chapter 4.

Before moving on to the definition of implementation tools, it should be noted that information for developing these specific questions into a monitoring and research program comes from many sources, including analysis of ongoing and existing research results, evaluation of agency monitoring programs and activities, and input from a variety of interest groups including scientists, resource managers and the communities. Over the long-term one of the most valuable resources for identifying research questions may be the legacy of scientific information and results from community involvement projects from the EVOS Restoration Program. The following chapter (3) describes the process by which gap analysis, synthesis, and research are used to implement the GEM Program and guide selection of variables for long-term monitoring, followed by the chapter (4) in which specific questions are asked, and answered.

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3. TOOLS AND STRATEGIES

In This Chapter

- Tools: Gap Analysis, Synthesis, Research, Monitoring, Modeling and Data Management
- Strategies: Community Involvement and Traditional Knowledge, and Resource Management Applicability

3.1 Introduction

The hypotheses presented in Chapter 2 are refined into a series of initial research questions through the use of gap analysis, synthesis, and modeling . These tools also will be used to continually refine and implement GEM's long-term core monitoring program. To further develop the program, the Trustee Council will use two major strategies: incorporation of community involvement and traditional knowledge, and potential for resource management applicability (Figure 3.1).

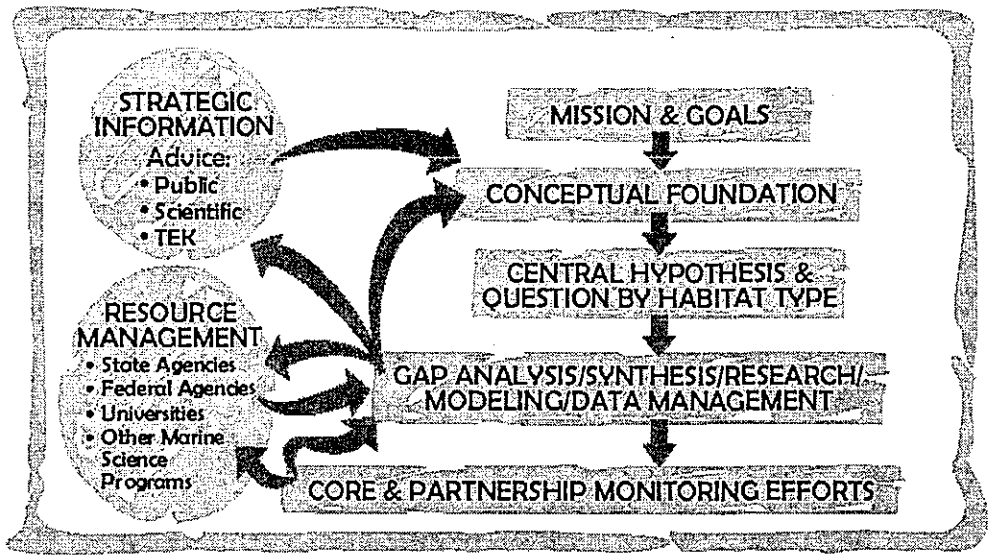

Figure 3.1 GEM Structure

This chapter defines and discusses these tools and strategies and explains how each will be used to implement the GEM Program.

3.2 Program Tools

Specific research questions emerge from a consideration of the central hypothesis and the key hypotheses for each habitat presented in the previous chapter. Preliminary specific research questions and the information necessary to answer them are presented in Chapter 4. The recommendations on the information needed were developed through a process of "gap analysis," as defined in the following section and as supported by information in Appendix D. From the starting point of preliminary questions and the information needed to answer them (Chapter 4), the GEM program is intended to follow a path of synthesis, research, and monitoring to detect, understand, and, eventually, predict changes in living marine-related resources of the northern GOA. Modeling and data management are critical elements in evaluating and managing the GEM long-term research program, and will closely support synthesis and research activities.

3.2.1 Gap Analysis

In the process of starting the GEM program, key hypotheses about how the GOA ecosystem functions were evaluated and refined into a set of key questions for each of the primary habitat types in the GOA (Chapter 2). The major information gathering programs in the North Pacific (Appendix D) were reviewed to identify where they are collecting data that could be used to answer the key questions, and where there were gaps in the information that would need to be filled by future research. This ongoing identification of information needs, or gap analysis, is an important part of the process of identifying the starting points for monitoring and research, for avoiding duplicating the efforts of others, and for continuing to refine the program as it progresses. This analysis will continue during implementation of the GEM program, with initial general questions being replaced by increasingly specific questions as knowledge about the ecosystem increases.

It is important to have a clear understanding of how the nature of the question determines the nature and outcome of the gap analysis. The gap analysis has four essential parts: a question, identification of information necessary to answer the question, a survey of relevant available information, and identification of gaps in the available information.

The first part, the question, is fundamental to the gap analysis and defines the survey of all relevant information needed to answer it. A general question calls for a general gap analysis, and a more detailed question calls for a more detailed gap analysis. The gap analysis seeks to identify what information is currently being collected that could help answer the question and what information, for which no data are being collected currently, is needed to answer the question. The data gaps become the priorities for focusing research and monitoring activities.

A continuing gap analysis, supported by a continuously updated database of current and historical information-gathering projects in the GOA and adjacent areas, is essential to implementing the GEM program. This analysis will be

performed by the staff and researchers and will be key to finding new partners for monitoring activities, identifying new opportunities for research and synthesis, and providing increased opportunities for collaboration, without risking duplication of effort or the possibility of failing to obtain needed data. In the short term, this database will provide information needed to select core monitoring variables and locations. In the longer term, the supporting database will become a valuable tool for resource managers, policy makers, other scientists, stakeholders, and the general public. As the GEM program moves from the general hypotheses about what controls and connects biological production within and between habitats, and toward specific questions and testable hypotheses, the gap analysis will become highly specific.

3.2.2 Synthesis

A second starting point for developing the GEM program is synthesis, because all good science ultimately involves synthesis. In the words of biologist E. O. Wilson (1998):

> *We are drowning in information while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information, think critically about it, and make important choices wisely.*

Synthesis builds on and updates the current understanding of the northern GOA. It brings together existing data from any number of disciplines, times, and regions to evaluate different aspects of the GEM program's conceptual foundation, central hypotheses, and related ideas. Synthesis has three broad uses. First, it is used to provide direction for developing hypotheses to be tested and, combined with research and monitoring, to update and refine the program structure and implementation plan. In this respect, synthesis is an ongoing evaluative process throughout the life of the GEM Program that will help to ensure that the program is meeting its goals and objectives. Second, synthesis is used as a tool to inform stakeholders and the public about the developing understanding of the factors responsible for change in the marine environment. Some of the most important synthesizers of GEM monitoring and research will be the public. Synthesis will be useful in workshops, meetings, publications, and other methods for communicating information to the public. And third, synthesis is used to help solve resource management problems, by identifying new applications of existing information or by identifying opportunities to solve existing problems by collecting new information. Synthesis is a logical place to begin the cycle of monitoring and research, but once used to initiate a project or component, it becomes a companion to monitoring and research and an ongoing part of the overall program.

For the purposes of the GEM program, synthesis is distinguished separately from research and from retrospective analysis, a form of research. Unlike research, synthesis does not necessarily start from a specific hypothesis or question. Instead, synthesis takes an interdisciplinary approach to evaluating existing information or data to identify potential new applications and uses. As such, synthesis is a critical

component in ensuring that cross-disciplinary and cross-habitat linkages and processes are adequately considered during research and monitoring. Synthesis may be supported by various forms of retrospective analysis (discussed below).

3.2.3 Research

Except in the case of synthesis, research is defined under GEM as collecting relatively short time series of new observations to evaluate a testable hypothesis relating to the conceptual foundation or a specific aspect of the monitoring program. In the early stages of GEM program implementation, research including synthesis, will be critical in helping to identify the core variables around which the long-term monitoring activities will be developed. For example, when synthesis, modeling, or other analysis indicates the need for measuring a core variable, research may be necessary to understand how to gather the data in a specific locality. Research may build on or use existing data and may also build models. Testing current understandings through research provides the basis for making changes to the monitoring program.

Retrospective analysis is treated in the GEM program as a specialized form of research, sometimes used as an integral component of synthesis, that employs existing time series data to evaluate a testable hypothesis or other questions of similar specificity relating to monitoring, often supported by statistical modeling. Retrospective analysis contributes to building numerical models and to synthesis.

Research, in the form of *process studies*, plays a vital role in moving beyond the correlative relationships that arise from the monitoring efforts to understand the underlying mechanisms controlling biological production both within and across habitat types. Process studies develop information on the mechanisms through which energy and matter are transferred across varying scales of time and space. This critical deeper understanding is essential to provide a framework and substance for the numerical modeling and synthesis. Large-scale process studies may encompass ecosystem-level processes occurring across multiple trophic levels, water masses, and habitat types; whereas small-scale studies may deal with mechanisms as specific as the digestion rates of individual animals. Processes such as predation, nutrient transport, and heat transfer are critical to understanding changes in living marine-related resources. Process studies support model building by defining relationships among individuals and species and between phenomena such as primary production and physical forcing. Process studies also contribute to other forms of research, such as retrospective analysis, and to synthesis.

The short-term end point for GEM program synthesis and research is implementation of core monitoring activities that are refined as suggested by new information. The continuing roles for synthesis and research, as supported by modeling, are to advance understanding of the relationships among and within the broad habitat types of the ecosystems, plant and animal species, physical and chemical oceanographic processes, and climate in the northern GOA in accordance

with the conceptual foundation. Continual refinement and testing of hypotheses, synthesis across geographic areas and species, and modeling of biological and physical processes are expected. As seen in Figure 2.1, synthesis is expected to play a dominant role in defining the monitoring program during the early years of the program, with the relative amount of revenues devoted to synthesis declining as long-term monitoring sites are selected and implemented. Synthesis will nonetheless continue to be important indefinitely, as a means for understanding and improving the flow information produced by the monitoring programs.

3.2.4 Monitoring

As defined for the purposes of the GEM program, monitoring is the action of repeatedly collecting long-time series observations. At the level of data acquisition, monitoring differs from research primarily in the length of time over which the measurements are taken, and the nature of methods and devices employed. Monitoring differs from research by employing methods and devices that are "tried and true," whereas research may use experimental devices or novel methods to acquire data. For example, observations now considered monitoring, such as satellite observations of sea surface height, were once seen as novel research. Such satellite observations remain in the research domain to some extent, as efforts to refine the spatial resolution of the available data continue.

The decision on what and where to monitor is based on the results of research and synthesis to identify core variables. The development of long time series of data is essential to detecting and understanding change in the ecosystem. When combined with research and modeling, monitoring can demonstrate how ecosystems change over time and in response to various inputs. As such, it provides a sound scientific basis for making a variety of management decisions potentially affecting ecosystem resources. Appropriate temporal and spatial scales for the hypotheses being analyzed are important aspects of detecting change, and, are therefore, key considerations in the design of monitoring.

Monitoring in the GEM program will be organized into core monitoring and partnership monitoring. Because of its critical importance to meeting the program's goals and objectives, *core monitoring* based on a set of core variables will be fully supported by the GEM program. *Partnership monitoring* is envisioned to extend the GEM core monitoring program by teaming with partners involved in research that is also relevant to the hypotheses that GEM will be testing. Partnership monitoring will be partially supported by leveraging GEM resources with the resources of the partner organization.

The end point for monitoring is a geographically distributed network gathering data on the state of the marine ecosystem in the GEM region, using spatially structured survey methods. This implies a broad spatial scale for monitoring, as a combination of GEM with that of other entities. These data are transformed into information for user groups by using synthesis, research, modeling, data management, and information transfer.

3.2.5 Modeling

Modeling is used to make the relationships between the parts and processes of the ecosystem clear, and as such, serve as a critical element in making connections between habitats and across disciplines. Models are tools for organizing data and telling a story and can be written in a variety of media as verbal, visual, statistical, or numerical models. In the GEM program, the specific purposes of modeling are to help accomplish the following:

- Inform, communicate, and provide common problem definition;
- Identify core variables and relationships;
- Set priorities;
- Improve and develop experimental designs to attain monitoring objectives;
- Evaluate cross-habitat linkages and transfers; and
- Improve decision-making and risk assessment.

Modeling, monitoring, and data management strategies need to work in concert for each to be fully effective (Figure 3.2). Modeling is a pivotal link between monitoring and data management and information transfer on the one hand, and synthesis and research on the other. Modeling feeds back information to the monitoring program in the form of recommendations on how the monitoring system can be made more effective. Modeling also helps interpret data for the use of synthesis and research activities.

There are quite a few synonyms for the types of models defined for the purposes of the GEM program. Verbal models are also known as "qualitative" and

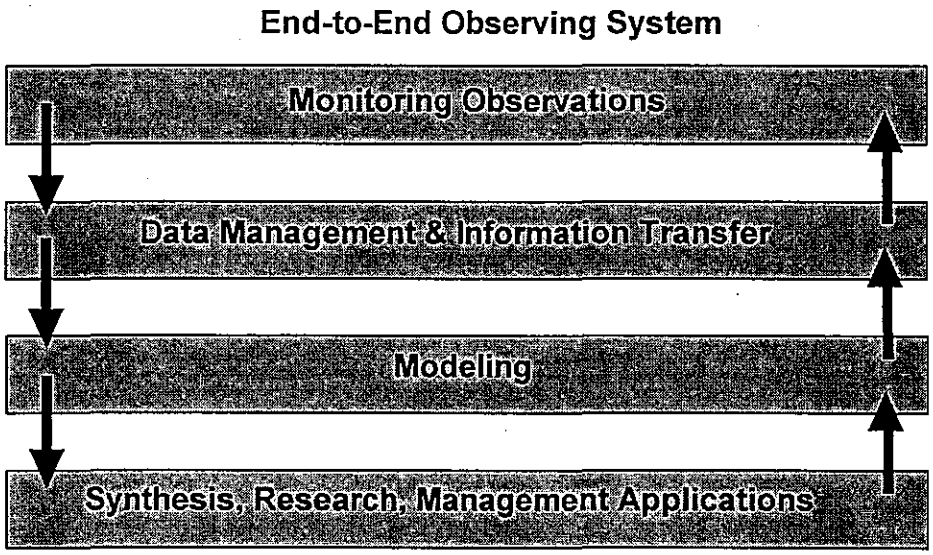

Figure 3.2 The End-to-End Observing System in which the monitoring observations are linked by data management and information transfer to end users, including modeling, synthesis, research, and management applications. (Adapted from Tom Malone [U.S. GOOS Steering Committee 2000]).

"conceptual"; statistical models are also known as "correlative" and "stochastic"; and numerical models are also known as "deterministic" and "mechanistic." Note that "prediction," "simulation," and "analysis" are not types of models, but uses of models. For example, the use of any kind of statistical or numerical model to reproduce the behavior of a process, such as population growth, is known as a simulation. All four types of models will be used in the GEM program. In the near-term, however, models of biological phenomena are expected to be mostly verbal, visual, and statistical, whereas models of physical and chemical phenomena are likely to be primarily numerical, in addition to being verbal and statistical.

The long-term modeling end points for monitoring, synthesis, and research in GEM are working biophysical models that make managers, policy makers, and resource users aware of changes in natural resources, help them understand the human and natural origins of these changes, and give them some idea of what to expect in the future. A detailed discussion of the definitions and strategies for modeling in the GEM program is provided in Chapter 8.

3.2.6 Data Management and Information Transfer

Data management and information transfer are the processes of acquiring in the field, receiving in the office, formatting, and storing data; providing quality control and assurance; developing and managing databases; and making the data understandable and available to users (See also Chapter 9). It includes the development of information products based on interpreted data and the delivery of these products, including user interfaces. The immediate objective of data management and information transfer is to ensure that the data collected by projects under GEM are well documented, safely stored, and accessible to the public within a reasonable period of time after collection. An ongoing objective of data management and information transfer in the GEM program is to achieve to the extent possible the documentation, storage and public access for past data acquired with EVOS funds under the NRDA and Restoration programs of the Trustee Council.

The long-term end point for GEM data management and information transfer is a system that manages the rapid and efficient flow of data and information based on core monitoring projects to end users, and that facilitates the flow of data and information between and among GEM partners and the user community.

GEM data management is a program support function intended to accomplish the following:

- Support cross-disciplinary integration of physical and biological information, and traditional knowledge within a structured, decision-making framework;
- Support synthesis, research, and modeling that evaluate testable hypotheses on the roles of natural forces and human activities in controlling biological production; and

- Lay the groundwork for future use of distributed, Web-based analysis and management tools as the monitoring program becomes fully operational.

By necessity, the data incorporated into the GEM program will be derived from a variety of sources and formats, which will include retrospective data sets and traditional knowledge and may contain spatial and temporal components. Synthesis and research will need to incorporate data not directly collected by the GEM program, such as satellite remote-sensing information and fishery catch data. Incorporation of these data into regional models and decision-making systems will require tools for data ingestion and query, especially to facilitate modeling. Because the output from the GEM program will be used by people from a wide variety of disciplines and backgrounds, the user interfaces must be easy to understand and accessible through a distributed network, such as the Internet.

Data management and acquisition policies are essential to ensure the rapid transfer of information to end users. Although the data must flow through the system as quickly as possible, quality control and assurance procedures and the prerogatives of scientists to publish interpretations of the data need to be respected. One approach that may prove useful is the establishment of "peer reviewed" data sets that allow the scientists involved to receive credit for their efforts in the publications of other scientists who may use the data.

Information transfer products will depend on the nature of the monitoring and research activities that are yet to be chosen. Possibilities for these products, based on the experience of other monitoring and research programs, are discussed in Chapter 9 and could include models and measures relevant to determining the productivity of key species such as salmon.

3.3 GEM Program Strategies

The previous section discussed the standard tools that will be used to develop and evaluate data and manage information in the GEM Program. This section presents two strategies that also will be important in guiding the GEM Program: incorporating traditional knowledge and community involvement, and potential for resource management applicability. These strategies will be applied to the GEM Program as a whole and will influence the way that the tools presented in the previous section are used.

3.3.1 Incorporating Traditional Knowledge and Community Involvement

Community involvement and the incorporation of traditional knowledge in the GEM program are critical to the program's long-term success. The significance of traditional knowledge is becoming increasingly recognized (IUCN 1986, Martinez 1994, Kimmer 2000) and can play a role in providing early warning signs of ecosystem change (Ford 2001). Local residents are expected to provide ecological knowledge that can be incorporated into established scientific models. They also can be a source of research questions which help ensure research that is relevant to

both ecological and community needs. Community-based monitoring efforts can efficiently collect essential data and build local stewardship as well as long-term support for the GEM program.

The EVOS settlement requires meaningful public involvement in all Trustee Council programs, as well as a Public Advisory Committee. Residents of coastal communities have a direct interest in scientific and management decisions and activities concerning the fish and wildlife resources and environments on which they depend for their livelihoods and sustenance (Huntington 1992). The Trustee Council believes that encouraging local awareness and participation in research and monitoring enhances long-term stewardship of living marine resources.

Community involvement can occur in many ways. Several approaches have been tried in the EVOS restoration program and elsewhere in Alaska and other northern regions, and GEM will draw on these experiences to design specific processes for involving communities and their expertise(Huntington 2000, Brown-Schwalenberg et al. 1998, Fehr and Hurst 1996, Hansen 1994, Brooke 1993). One avenue is through active membership on the 20-member Public Advisory Committee, made up of representatives of tribal and incorporated communities, stakeholders, scientists and members of the general public. Another is through active participation of public members on various scientific subcommittees and work groups and during targeted workshops to help plan and guide the GEM Program as it develops. Other ways include having citizens, students and communities implement local monitoring activities.

Traditional and local ecological knowledge can provide important observations and insights about changes in the status and health of marine resources (Huntington 1998). With Trustee Council funding, Alaska Native tribes in the GEM research area are currently developing natural resource plans that will help identify important resources and potential threats and be useful in designing local monitoring schemes that help answer key questions for the GEM program.

The Trustee Council has always listened closely to the views and interests of the people living in the spill-affected region, and responded to their concerns consistent with the legal restrictions of the EVOS settlement funds. Under the terms of the settlement, restoration funds can only be used to respond to injuries to the public's natural resources – not injury to individuals or to communities. However, the communities have the well being of these resources at heart, and any program to provide for the long-term health of the resources, has the benefit of providing for the long-term health of the local communities.

3.3.2 Potential for Resource Management Applicability

The GEM program is intended to increase and enhance the information managers and stakeholders use to cope with changes in natural resources. To accomplish this, GEM will seek to acquire data with significant potential for use in resource management applications, ensure that data is converted into useful

information in a timely manner, and invite research and synthesis projects that both involve and benefit natural resource management agencies.

GEM questions are directed at understanding not only specific mechanisms of production in representative habitat types, but also the connections among habitat types.

Salmon fishery management illustrates management concerns that are common to most natural resources. The typical salmon fishery operates on a resource that depends on a variety of habitat types (freshwater, nearshore, and offshore) during the course of its life cycle (Figure 3.3). Management of the salmon fishery requires detecting and understanding the consequences for production of habitat management decisions (Box 1.9, Figure 3.3) throughout the salmon's life cycle. GEM seeks to provide data relevant to answering specific questions about how a range of habitat types function to produce salmon and other species. The cyclic nature of the salmon fishery in time and space makes it clear that biological production in one habitat type cannot be understood in isolation from production in the other habitat types in which the salmon completes its life cycle. GEM questions are directed at understanding not only specific mechanisms of production in representative habitat types, but also the connections among habitat types.

The management applications actually achieved will depend on a variety of factors, including the degree to which resource managers participate in the review, development, and implementation of the GEM program.

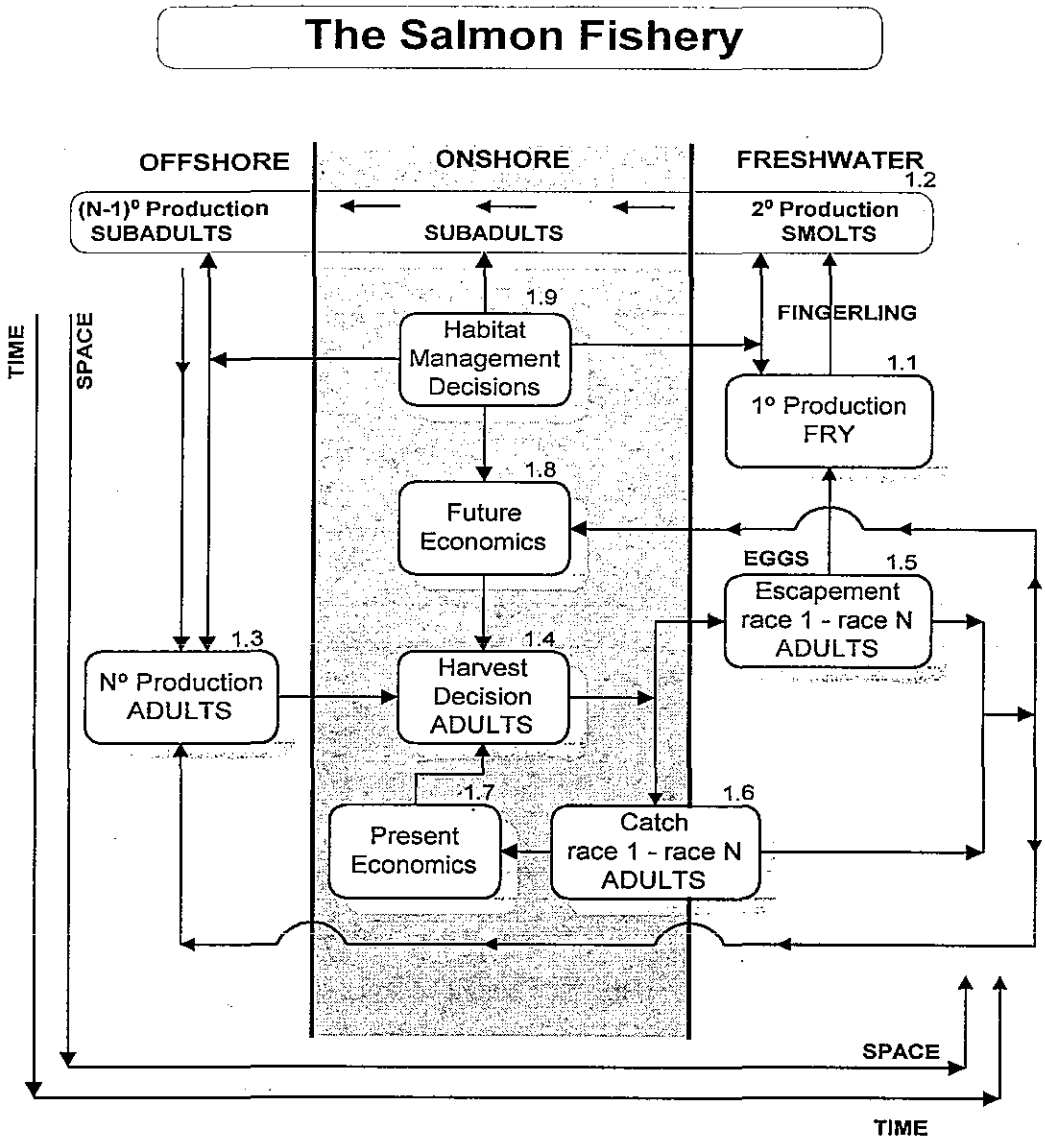

Figure 3.3 Diagram of the salmon fishery with life cycle stages, harvest, and habitat management decisions in geographic and temporal contexts (Mundy 1998).

3.4 Conclusion

The tools and strategies described above are used together to make the GEM program scientifically sound, compatible with other programs, relevant to communities and resource managers, and open to the information local residents may provide. Using the tools and strategies to implement the GEM Program is addressed in following chapter.

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4. PROGRAM IMPLEMENTATION

In This Chapter

- Introduction to the GEM Science Plan
- Conceptual Foundation by Habitat
- Key Questions by Habitat
- GEM Program Implementation

This Chapter describes the starting point for developing the GEM Science Plan. As such it should be considered a work in constant progress. The GEM Science Plan will be periodically updated in response to direction from the Scientific and Technical Advisory Committee, its subcommittees, and using input from communities and the general public (see Chapter 5), so changes to potential research questions during the early years of the program could be substantial.

4.1 Introduction

Before the general hypotheses developed and presented in Chapters 2 and 3 can be used to guide the GEM research and monitoring program, they need to be refined into a set of specific research questions, and the research questions need to be evaluated to determine what data need to be collected and analyzed to answer them. The process and timelines for defining, asking, and getting the data to answer the questions, also known as research and monitoring, is described by the GEM Science Plan, which does not now exist as a complete and finished document.

The goal of the Science Plan is to implement a long-term monitoring program, which can only be done after the requisite synthesis and research have been completed. Since this long-term monitoring program will become the "flagship" of the GEM program, the steps toward implementation need to be carefully taken.

This chapter extends the GEM conceptual foundation (through the primary physical and biological processes, and human activities believed to be most important in affecting change in the GOA) to each general habitat type. From this information, and building on the key habitat hypotheses, a series of potential questions have been developed that can be used as a starting point for identifying initial research activities. The potential research questions presented in these sections are meant to capture some of the main uncertainties in how fluctuations in the northern GOA ecosystem influence the distribution and abundance of valued organisms. They do not attempt to capture the entire scope of potential research questions. Instead, they address discrete aspects of the conceptual foundation and

are starting points for identifying research activities. As knowledge of the ecosystem increases, the research questions are expected to gain greater specificity and refinement through ongoing hypothesis testing initial gap analysis, and identification of specific information needs. It is expected that the potential research questions may change as a result of the Scientific and Technical Advisory Committee process described in Chapter 5.

Following the habitat-specific research questions is an initial implementation plan for the GEM program during a 5-year period, from FY 03 to FY 07. This plan incorporates the following elements:

- A *proposed schedule for implementation*, FY 03 to FY 07, for core and partnership activities, models, and data management.
- Lists of probable or *prospective partners* that are actively doing related monitoring or research in the broad habitat type.
- Development of *models* as a way to synthesize monitoring and research results and transfer information to end users.
- *Candidate (possible) core monitoring activities* recommended based on the conjunction of partnership opportunities and opportunities for measuring biological and physical quantities related to the key question and information gaps.
- *Candidate (possible) core variables* recommended based on approaches suggested by the literature reviewed in the scientific background (Chapter 7).

The proposed schedule for implementing GEM monitoring activities in the watershed, intertidal/subtidal, and ACC habitat areas is similar, but modeling and data management needs differ in each habitat. For offshore research, GEM will primarily be involved in partnering activities, since research offshore is already being undertaken by a number of other large-scale programs. As a result, the schedule for implementation largely is dependent on the implementation schedules for partner programs.

4.2 Watersheds

4.2.1 Conceptual Foundation for Watersheds

Watersheds are linked by biogeochemical cycles and common climatic forcing to the marine ecosystem. Input of terrestrial carbon contributes to the carbon budget of the oceans. Likewise, marine contributions of nutrients appear to be important to growth of aquatic and terrestrial plants and animals in watersheds.

Primary natural forces are precipitation and insolation. Watersheds depend on import of marine nutrients by anadromous fish and other animals. Therefore,

maintenance of healthy salmon runs and populations of terrestrial animals that feed in the nearshore marine environment is key to healthy watershed ecosystems. Woody debris and vegetation from land are also exported to the marine environment, providing a carbon source and habitat for some species. The common effects of climate also link these two systems. Fresh water from coastal watersheds contributes huge amounts of fresh water to the GOA and makes possible the Alaska Coastal Current–the single most dominant and integrating feature of the physical environment on the continental shelf.

Human activities in the watersheds that remove natural vegetation can result in soil erosion and its attendant effects on stream and coastal marine life. Fresh water can carry contaminants to the marine environment. Sources of these contaminants can be of local origin–sewage and septic wastes, industrial and military wastes, motor vehicles, and oil from spills–or imported from distant sources and carried across the Pacific Ocean by atmospheric processes.

Key Hypothesis: ***Natural forces (such as climate) and human activities (such as habitat degradation and fishing) serve as distant and local factors in causing short-term and long-lasting changes in marine-related biological production in watersheds.***

4.2.2 Potential Watershed Questions:

a. What are levels of marine-related nutrients in watersheds and how do the annual inputs of marine nutrients vary?

   Specific Information Needs: Levels of nitrogen-stable isotopes in freshwater plants and animals, and feasibility of studying sources of precursors of reduced iron in watersheds with marine access.

b. What is the annual variability in precipitation and runoff in Alaska watersheds bordering the northern GOA? (Same question applies to intertidal-subtidal and ACC habitats.)

   Specific Information Needs: Annual precipitation and runoff for all watersheds flowing into the northern GOA. In some cases, where data gaps exist, it may be possible to use marine salinity data to supplement precipitation and stream flow measures in estimating total freshwater run off from land to the GOA. Input of the amount of fresh water entering the GOA from northern British Columbia and Southeast Alaska would also be needed to use marine salinity as a proxy for freshwater runoff.

c. What are the levels of contaminants entering and leaving watersheds along marine-related pathways?

   Specific Information Needs: Levels of contaminants such as persistent organic pollutants (POPs) in anadromous species as adult immigrants and as juvenile emigrants of the watersheds

4.2.3 Program Implementation

Development of watershed monitoring activity will be led by a core synthesis effort in FY 03, building on preparatory core research in FY 02 to establish an approach to measuring levels of marine influence in animals and plants of the watersheds. Core synthesis will assist in developing hypotheses by about FY 04 that can be tested and refined by core research in FY 05 and FY 06. At least one core monitoring station will be initiated by FY 06, but may not be fully operational until FY 07.

Table 4.1 presents the proposed schedule for implementation.

Table 4. 1 Proposed Implementation Schedule for Watershed Habitat

Fiscal Year	Monitoring Activity		Model	Data Management
	Core	Partners		
2003	Synthesis Research	Monitor	Verbal(c)	Prototype
2004	Synthesis Research	Monitor Research	Statistical(c)	Coordination (c) Archiving(c)
2005	Research	Monitor Research	Statistical(c) Numerical prototype (p)	Coordination (c) Archiving (c) Distribution (p)
2006	Research Monitor	Monitor Research	Statistical(c) Numerical (p)	Coordination (c) Archiving (c) Distribution (p)
2007	Monitor Research	Monitor	Numerical (p)	Archiving (c) Distribution (p)

Notes:

c = core (GEM program supported) activity

p = partnership (jointly supported) activity

Prospective partners: ADF&G, USFWS (Kenai Natural Wildlife Refuge [KNWR]), USGS, EPA, ADEC, USFS, Cook Inlet Keeper (CIK), Alaska Department of Natural Resources (ADNR), and Washington Department of Fish and Wildlife (WDFW)

Candidate core monitoring activities: Kenai River watershed, Karluk River watershed.

Candidate core variables: isotopes of nitrogen in aquatic and riparian plants and animals, precursors of reduced iron in water, and anadromous fish.

4.2.4 Prospective Partners and Partner Activities

Partner activities in FY 03 are expected to be the supporting monitoring programs already in place, such as enumeration of animals and plants; water quality monitoring; existing hydrology models, including annual and seasonal runoff; and permitting of human activities such as resource harvests and land development. Starting in FY 04, partners will be encouraged to assist in funding research to further site selection. This activity will extend through FY 06,

terminating after the monitoring stations are fully operational. Because an analogous research program is underway at the Washington Department of Fish and Wildlife (WDFW), that agency may be willing to share information and the costs of process studies of mutual interest.

4.2.5 Models

Models of the relationship between marine productivity and watershed productivity (Finney et al. 2000) will likely be verbal as of FY 03. Statistical modeling to describe the strength of relations among variables and power analysis to guide sampling should start in FY 04, continuing through the evaluation of the initial monitoring station in FY 06. The end point of modeling will be a numerical model of the geochemistry of the core variable(s) in the watershed to the boundary of the intertidal and subtidal areas. This model will be initiated in about FY 05 and operational (in some sense) by FY 07. It is recognized that a number of partner monitoring activities in addition to the core activity will be needed to create parameters for a numerical model. If numerical modeling proves intractable, statistical modeling would be extended in the interim.

4.2.6 Candidate Core Monitoring Activities

Candidate core monitoring activities will be chosen to build on existing long time series of data collected by prospective partners. The Kenai and Karluk rivers are two likely candidates. For the Kenai River watershed, three decades of data on adult salmon returns to the spawning grounds of the watershed can be used as estimates of marine influence. In addition, salmon catch data span more than five decades. The proximity to Anchorage places the Kenai River watershed under heavy pressure from human activities and their associated impacts, many of which are documented by government regulators. Multiple prospective partners have extensive programs in place to monitor vegetation, terrestrial animals, limnology, and other variables of potential relevance to the key question. The Karluk River watershed is unique in having a published record of more than 300 years of changes in marine influence in general, and marine nitrogen in particular (Finney et al. 2000). In addition, the prospective partners have collected more than eight decades of counts of salmon returns for the watershed.

4.2.7 Candidate Core Variables

Isotopes of nitrogen in plants and animals and sources of reduced iron are candidates for core variables, based on work described in the scientific background under marine-terrestrial connections (Chapter 7, Section 4) and chemical oceanography (Chapter 7, Section6). In watersheds of the GEM region, where nitrogen limits productivity, marine nitrogen in anadromous fish species, principally salmon, could be an important driver of watershed productivity. Phosphorus and iron from salmon may also be important to watershed productivity, but direct measures of the origin of these elements are not available.

Indirect measures might be, for example, phosphorus or iron concentration per gram of fish times average fish weight times return number. A decade of work on the role of iron in primary productivity in marine areas suggests that geophysical and biological processes in watersheds may contribute to marine productivity. Processes in the watersheds may limit marine productivity by controlling the availability of precursors of reduced iron.

4.3 Intertidal and Subtidal

The intertidal and subtidal–or nearshore–area is technically a part of the ACC regime in most places (the next habitat to be considered), except arguably in some embayments, such as the fjord systems in northern PWS. But, because of the importance and vulnerability of the intertidal and shallow subtidal areas and the dependence of so many valued species on nearshore habitat, it is treated here separately from the ACC.

4.3.1 Conceptual Foundation for Intertidal and Subtidal

The productivity of intertidal and subtidal marine communities depends on both fixed algae and some other vascular plants in shallow water, as well as free-floating phytoplankton. Nutrient supply to fixed plants is not well characterized, but presumably is controlled by oceanographic processes and seasonal cycles of water turnover on the inner shelf as well as some contributions from stream runoff. This process of nutrient supply is essentially the same as for nearshore phytoplankton. Ultimately, as mentioned in Chapter 7, Section 5.3, the run up of deepwater from the central GOA onto the shelf and some poorly characterized processes for cross-shelf transport of the nutrients are critical to growth of both fixed and floating nearshore algae. The nearshore waters can be depleted of nutrients during the growing season if the warm surface layers where primary productivity is drawing down nutrients is not mixed with deeper waters by wind and tidal action. Within-season variability in primary production, therefore, appears to depend on the previous late summer run up of deepwater onto the shelf, some poorly described cross-shelf transport processes, and within-growing season wind and tidal mixing.

Cloud cover also is likely to be very important in regulating the amount of solar energy reaching the ocean surface. Nearshore turbulence, which is the result of the prevailing climate and tidal action, promotes the growth of algae and phytoplankton. These plants are the food supplies for filter-feeding mollusks, such as clams and mussels, which are important sources of food for a variety of nearshore animals, such as sea otters and sea ducks. Climate also directly affects intertidal and subtidal animals through changes of temperature, water salinity, and ice formation. Ice formation is an important source of mortality and reduced growth of intertidal algae and some animal populations in some situations. It is suspected that bottom-up forcing through variability of primary production is an important influence on intertidal invertebrate communities on the scale of decades, but there are no long-term data sets to examine this supposition. If wave action is

too intense, it can limit population growth; for example, waves during storms often throw large amounts of herring eggs (embryos) onto the beach where they die.

A large number of intertidal and subtidal animal populations respond to both bottom-up and top-down natural forcing as well as to human activities. Bottom-up forcing appears to have more documented effects on such populations as herring, pollock, shrimp, crab, salmon, and seabirds than have been documented for infaunal and attached intertidal animals. There are good examples of population controls by removals (top-down influences) and many of these relationships, such as that between sea urchins and sea otters, are cited in Chapter 7, Section 12.2.5. Disease possibly influences some populations, such as *Viral Hemorrhagic Septicemia* virus effects on Pacific herring in PWS.

The intertidal and subtidal benthos is particularly vulnerable to human use through harvesting of various invertebrates, trampling, discharge of contaminants, road and home construction, and soil erosion. At the present time, impacts of such activities appear to be localized because of the dispersed nature of human activities along the vast coastline of the northern GOA. The nearshore sentinel populations may need to be monitored more closely, however, as Alaska's population and use of the nearshore zone expands in the future.

Key Hypothesis: ***Natural forces (such as currents and predation) and human activities (such as increased urbanization and localized pollution) serve as distant and local factors, in causing short-term and long-lasting changes in community structure and dynamics of the intertidal and subtidal habitats.***

4.3.2 Potential Intertidal and Subtidal Question:

a. What is the variability of selected plant and animal populations in the intertidal and subtidal zones?

Specific Information Needs:

- Variability in numbers and diversity of fixed algae and invertebrates in several regions, such as PWS, Kachemak Bay, and Kodiak Island.
- Relative availability of larval dispersal stages.
- Measures of the cycling of carbon, nutrients, and contaminants in key species such as *Fucus*.
- A detailed map of intertidal plant biomass during the growing season on a wide spatial scale.
- Monitoring of clam populations.
- Measurements of population processes of sea otters.

- Identification and measurement of human impacts of concern.

4.3.3 Program Implementation

Development of the intertidal and subtidal monitoring activities is expected to begin with a planning workshop in FY 02 and an intense core synthesis effort in FY 03 that involves extensive preparatory core research. The inherently high variability of the community structure of the intertidal and subtidal habitat–and its vulnerability to the effects of predation and human degradation–may make it difficult to develop a design that can separate human activities from natural forces, forestalling implementation of initial monitoring until FY 06. Core synthesis is planned to provide hypotheses by about FY 05 that can be tested and refined by core research in FY 06 and FY 07. The initial schedule calls for at least one core monitoring station to be initiated by FY 06, but it may not be fully operational until FY 07.

Table 4.2 presents the proposed schedule for implementation.

Table 4. 2 Proposed Implementation Schedule for Intertidal and Subtidal Habitat

Fiscal Year	Monitoring Activity		Model	Data Management
	Core	Partners		
2003	Synthesis Research	Monitor	Verbal(c) Statistical(c)	Prototype Coordination (c)
2004	Synthesis Research	Monitor Research	Verbal(c) Statistical(c)	Coordination (c) Archiving(c)
2005	Research	Monitor Research	Verbal(c) Statistical(c)	Coordination (c) Archiving (c) Distribution (p)
2006	Research Monitor	Monitor Research	Statistical(c)	Coordination (c) Archiving (c) Distribution (p)
2007	Monitor Research	Monitor	Statistical(c) Numerical prototype (p)	Archiving (c) Distribution (p)

Notes:

c = core (GEM program supported) activity

p = partnership (jointly supported) activity

Prospective partners: ADF&G (Kachemak Bay National Estuarine Research Reserve [KBNERR]), NOAA (National Ocean Service) UAF, Cook Inlet Regional Citizens Advisory Council (CIRCAC), Prince William Sound Regional Citizens Advisory Council (PWSRCAC), USFS, EPA-ADEC (EMAP), Alyeska Pipeline Service Company

Candidate core monitoring activities: Kachemak Bay (lower Cook Inlet), Green Island (PWS)

Candidate core variables: substrate type and distribution, species composition and distribution, recruitment

4.3.4 Prospective Partner Activities

Partner activities in FY 03 will be the supporting monitoring programs already in place, such as monitoring of individual species for basic biology and contaminant loads, surveys of species composition and distribution, surveys of substrates, and measurements of physical oceanography (see Table 4.2). Starting in FY 04, partners will be encouraged to assist in funding research to further site selection. These activities will extend through FY 06, terminating after the monitoring station is fully operational in FY 07.

4.3.5 Models

Models of changes in community structure of the intertidal-subtidal areas in response to human activities and natural forcing are expected to be primarily verbal from FY 03 to FY 05. Statistical modeling, particularly power analysis to guide sampling, is expected to be operable as soon as FY 03, because of experience gained in the EVOS coastal habitat program and related damage assessment and restoration work. Statistical modeling will continue through the evaluation of the initial monitoring station in FY 06. The end point of a numerical model to combine physical forcing and human activities for describing community structure is a very ambitious undertaking for a core activity within a 5-year time frame and may not be feasible at all without substantial partner support.

4.3.6 Candidate Core Monitoring Activities

Candidates for core monitoring activities will be selected based on substantial partnering opportunities, chances for assessing human activities and impacts, and logistics. Likely candidates are Kachemak Bay in Lower Cook Inlet and Green Island in PWS. Kachemak Bay is close to the city of Homer and becoming a developed recreational destination. In addition, the bay has the presence of coastal habitat assessment programs already in place within the Kachemak Bay National Estuarine Research Reserve (KBNERR), as well as nearby moorings taking oceanographic measurements. The USFS has a long-term ecological monitoring site at Green Island, which is still seeing effects from the 1989 oil spill. A new weather station is being installed nearby at Applegate Rocks, and additional oceanographic moorings in nearby Montague Strait are likely.

4.3.7 Candidate Core Variables

Community structure in the intertidal and subtidal areas is determined by substrate type and amount, as well as by physical oceanographic features, such as wave action. Species composition and distribution are fundamental to determining community structure, as is the recruitment rate of key species such as barnacles, mussels, and clams, depending on substrate.

4.4 Alaska Coastal Current

As noted above, the domain of the ACC in many cases starts at the shoreline and extends out to a frontal area several tens of kilometers onto the continental shelf. The inshore boundary of this current system is not precisely defined in this subsection because the nearshore aspects of the ecosystem have been covered above.

4.4.1 Conceptual Foundation for ACC

Because the ACC is a buoyant, low-salinity, eastern, boundary current fed essentially by a line-source of fresh water along the length of the Alaska coastline, it offers a unique opportunity to study basin-scale physical forcing of biological production. Although one characteristic of the ACC is the draw-down of nutrients during the growing season to levels that are undetectable, the in-season variability is clearly driven by patterns in the aforementioned wind mixing, and is very significant. A promising model developed by Eslinger et al. (2001) is capable of tracking the in-season variability of plankton production based on the physical characteristics of the water column and the wind field. The extent to which patterns of seasonal wind mixing are the major contributors to longer-term variability in primary productivity is not clear. Tidal mixing likely contributes to variability, as do other potential mechanisms that transport deep-water nutrients into shallow waters; for example, late-summer relaxation of onshore Ekman transport and up-canyon currents.

Annual variability of nutrient supply likely has a great influence on long-term variability in primary production. For example, this influence would be consistent with the relationship between the Bakun upwelling index and pink salmon marine survival rates up to 1990 (see Chapter 7) and the differences observed between the volumes of settled plankton in the 1980s and in the 1990s (Brown unpublished).

Another physical phenomenon that apparently affects biological production in the water column is eddies. Eddies have been documented in Shelikof Strait, for example, and greatly influence retention of larval pollock in a favorable environment (Bogard et al. 1994, Bailey et al. 1997). Beyond their study in the FOCI program, not much is known generally about eddies in the ACC and their biological influences. There are also eddies in Kachemak Bay, some of which are stratified at the surface by freshwater inputs that may similarly benefit pelagic species there and off Kayak Island, southeast of PWS. The southerly and easterly winds that predominate during most of the year drive offshore water inshore (via Ekman transport), carrying offshore planktonic organisms close to shore and providing potential sources of food for nearshore organisms, such as juvenile pink salmon.

Finally, the outer edge of the ACC often forms a front with the water masses seaward of it. This front is characterized by strong convergence of offshore and inshore water masses and significant downward water velocities. It appears at

times to concentrate plankton, nekton, fish, and birds, and is probably an important site for trophic interactions.

Many of the types of natural and human activities that affect the nearshore species apply also to the ACC. This similarity is due in part to the fact that many species cross between the nearshore environment and deeper waters. Bottom-up forcing appears to be of great importance, because areas of the ACC with high levels of chlorophyll a during the growing season and vigorous vertical mixing, such as Lower Cook Inlet, also support large populations of fish, seabirds and marine mammals. The ACC is the main domain of the GOA for the productive fisheries for both pelagic and benthic species. Consequently, human activities are potentially a quite large aspect of removals. Other possible human impacts include contaminants and long-term global warming.

Key Hypothesis: ***Natural forces (such as variability in the strength, structure and dynamics of the ACC) and human activities (such as fishing and pollution) cause local and distant changes in production of phytoplankton, zooplankton, birds, fish, and mammals.***

4.4.2 Potential Alaska Coastal Current Questions:

a. What is the annual variability of strength, location and dynamics of the ACC?

   Specific Information Needs: Measurements of variability in temperature and salinity with depth, on time scales from days to multiple decades at locations sufficient to understand seasonal-scale variability and at localities sufficiently widely dispersed to understand large-scale structure, including intrusion into bays.

b. What is the variability in the supply of deepwater nutrients to the photic zone of the ACC and their concentrations in that zone on time and space scales appropriate to understanding annual primary production?

   Specific Information Needs: Measurements of, or proportional to, macronutrients and micronutrients at appropriate spatial scales.

c. What is the variability in chlorophyll a concentrations and phytoplankton species composition in the photic zone of the ACC on time and space scales appropriate to understanding annual primary production?

   Specific Information Needs:

   - Chlorophyll a measurements.
   - Information on phytoplankton species composition.

d. What is the variability of zooplankton biomass and species composition in the ACC on time and space scales appropriate to understanding annual primary and secondary production?

Specific Information Needs: Information about zooplankton biomass and species composition.

e. What is the variability in the availability of forage fish to higher trophic levels (birds, fish, mammals) in the ACC?

Specific Information Needs:

- Analyses of the diets of selected higher-trophic-level organisms (birds, mammals, large predatory fish).
- Analyses of selected higher-trophic-level organisms (birds, mammals, large predatory fish) for fatty acid composition in relation to diet.

f. What are the major factors affecting long-term changes in sea bird populations?

Specific Information Needs: Annual colony and chick productivity counts of appropriate species in selected GOA colonies. See also information needs for Question A-5 above.

g. What are the major factors affecting long-term changes in harbor seal populations?

Specific Information Needs:

- Annual surveys of molting population in selected GOA haul-outs.
- Fatty acid profiles of individual animals and scat analysis surveys in selected GOA haul-outs.

4.4.3 Program Implementation

Development of ACC monitoring will require a period of synthesis and research that involves collaboration between physical and biological scientists to decide on how to best detect changes in annual and seasonal production and transfer of energy to higher trophic levels. The determination of what physical-chemical processes are most important to measure for primary and secondary production will require a synthesis that combines existing physical and biological information and hypotheses. Specific seasonal questions such as what controls the timing, duration, and magnitude of the spring bloom on the inner continental shelf need to be carefully cast as testable hypotheses before committing to long-term monitoring. Having the SEA, APEX, GLOBEC Northeast Pacific National Estuary Program (NEP), FOCI, OCC, and NPAFC programs precede and parallel the GEM program is extremely fortuitous for development of this component. The

experience and lessons from these programs will be extremely beneficial in helping GEM build its core monitoring components. For these reasons, development of ACC monitoring activity will begin with a core synthesis effort that is closely coordinated with the ongoing research and monitoring efforts mentioned above.

Understanding how best to measure biological productivity and trophic transfer in the ACC will take longer to develop than the approach to physical measurements, which could be developed in a relatively short period of time. The long-term observation program being carried out in PWS and across the shelf in the northern GOA under GLOBEC started in 1997 and will extend through 2004. Intense process studies are scheduled for 2001 and 2003. It will take some time to distill the large amount of information available from such studies and other programs to the point of recommending a full suite of core biological measurements for core GEM program monitoring in the ACC.

Table 4.3 presents the proposed schedule for implementation.

Table 4. 3 Proposed Implementation Schedule for Alaska Coastal Current Habitat

	Monitoring Activity			
Fiscal Year	Core	Partners	Model	Data Management
2003	Synthesis Research	Monitor	Statistical(c) Numerical (p)	Coordination (c)
2004	Synthesis Research	Monitor Research	Statistical(c) Numerical (p)	Coordination (c) Archiving(c)
2005	Research	Monitor Research	Statistical(c) Numerical prototype (p)	Coordination (c) Archiving (c) Distribution (p)
2006	Research Monitor	Monitor Research	Statistical(c) Numerical (p)	Coordination (c) Archiving (c) Distribution (p)
2007	Monitor Research	Monitor	Numerical (p)	Archiving (c) Distribution (p)

Notes:

c = core (GEM program supported) activity

p = partnership (jointly supported) activity

Prospective partners: UAF (IMS, School of Fisheries and Ocean Sciences [SFOS]), U.S. Department of Interior (DOI) (National Park Service [NPS], USFWS, USGS), North Pacific Research Board (NPRB), NOAA (NMFS/National Ocean Service [NOS]), EPA-ADEC EMAP

Candidate core monitoring activities: GAK1, Hinchinbrook Entrance, Montague Strait

Candidate core variables: temperature, salinity, fluorescence, plankton, forage species

4.4.4 Prospective Partner Activities

NOAA's interest in the ACC continues to be high, as demonstrated through its participation in the GLOBEC and OCC programs and some continuing work in the

FOCI program in Shelikof Strait. It is almost certain that the GAK1 station and line, maintained and monitored by the University of Alaska and in place now for decades, will play a central role in future monitoring of the physical structure of the ACC based on temperature and salinity measures. Recently added biological measures, including chlorophyll a, will likely be maintained and supplemented. Other opportunities for partnerships include more recently established GLOBEC stations from PWS across the continental shelf and one of the lines used in the FOCI program in the Shelikof Strait. The USGS, which has an established set of seabird monitoring colonies spaced at about 500-km intervals around the GOA and into the Bering Sea, is another strong candidate for a partner. Close coordination with methods of the colonial seabird program of the USFWS Alaska Maritime Refuge is envisioned to make seabird data consistent around the coast of Alaska. For measuring forage species variability, population abundance data from the ADF&G on Pacific herring in PWS and also for populations at Kodiak Island and in Kamishak Bay, although not complete, may be useful. Starting in FY 04 and extending through FY 06, partners will be encouraged to assist in funding research to further site selection for monitoring the ACC.

Plankton measurements (settled volume) are taken now by potential partners at six hatcheries in PWS. On the basis of past correlations of plankton-settled volume with annual pink salmon returns and decadal-scale herring abundance, these data could provide information about productivity of the ACC system of relevance to multiple species under certain conditions. Extension of the "plankton watch" to hatcheries in other areas and local communities throughout the northern GOA may be a worthwhile and potentially economical way to maintain long-term data sets and archives of plankton. Other opportunities to collect samples and analyze plankton communities may include cruises with net and hydroacoustic sampling, as well as satellite images. Also of possible merit are the use of ships that offer opportunities; for example, the continuous plankton recorder is recommended to be deployed on oil tankers traveling from Valdez to Long Beach under EVOS sponsorship in FY 02. Certainly any satellite images of the sea surface that measure chlorophyll a concentrations provide very useful synoptic pictures, even taking into account the limitations that cloud cover and lack of subsurface data present. Decisions will be made with the guiding philosophy of collecting data of relatively low frequency in space and time so that decadal scale change can be resolved.

Perhaps the largest challenge for the ACC habitat will be developing monitoring activities to measure variability in forage fish populations and associated predator populations. Some options for exploration of partnerships for assessing forage fish abundance and associated phenomena include the following:

- Larval surveys building on the databases and archived specimens from the FOCI program.
- Use of forage fish occurrence in the stomachs of large fish collected in the sport fishery–or in some of the large fishery assessment programs

conducted by NOAA and ADF&G–as an index of relative abundance. (The Trustee Council sponsored a successful study of these occurrences of forage fish in the sport fishery for halibut out of Homer.)

- Small mesh trawl surveys conducted by ADF&G around Kodiak Island and lower Cook Inlet to assess shrimp abundance. (A large database from this program extends for some locations back to the 1960s for a large variety of species on the inner shelf.)
- Aerial surveys with the use of conventional photography or other sorts of imaging (such as LIDAR) of shallow water aggregations of juveniles or adults.
- Hydroacoustic sensors mounted on various ships of opportunity and fixed moorings.
- Analysis of food items brought back to the nests of colonial seabirds (such as puffins) as an indication of the relative abundance of various forage fish species in particular areas.
- Other net sampling programs that may be under way or contemplated.

4.4.5 Models

Several hydrographic and circulation models have been or are being developed for the ACC (see also Chapter 8, and Appendix E). A circulation model workshop is planned in FY 02 to consider approaches most likely to be useful to the GEM program. Models of the relationship of marine planktonic production to water column structure were developed in the EVOS SEA program (Eslinger et al. 2001) and are expected eventually to be developed further under the GEM program.

The GLOBEC nutrient-phytoplankton-zooplankton (NPZ) 1-D and 3-D models are a suite of coupled biological-physical models concerned with the coastal region of the GOA. They address effects of concern to the GEM program in the ACC and offshore: cross-shelf transport, upstream effects, local production, and conditions conducive to suitable juvenile salmon rearing habitat.

Models of particular interest from the FOCI program are the 1-D and 3-D versions of the Shelikof NPZ models, and the GOA Walleye Pollock Stochastic Switch Model (SSM) (see Chapter 8, and Appendix E). The Shelikof NPZ models are a set of coupled (biological and physical) models designed to examine hypotheses about pollock recruitment in the Shelikof Strait region. The Pollock SSM is a numerical simulation of the process of pollock recruitment. Of particular interest to the GEM program is the identification by the SSM of three specific agents of mortality: wind mixing, ocean eddies, and random effects. Ecopath models developed by Okey, Pauly, and others at the University of British Columbia are also of interest, especially for PWS, but also for the GOA continental shelf and slope (excluding fjord, estuarine, and intertidal areas) (see Appendix E).

4.4.6 Candidate Core Monitoring Activities

It appears that the physical oceanographers have developed a level of understanding about inner-shelf dynamics that will allow the GEM program to identify a core set of measurements, locations, and frequencies that address questions relevant to the GEM program. A core monitoring activity based on the partnership at the GAK1 station is likely. Others may be added in FY 04 to FY 07 as identified by synthesis and the results of other programs (GLOBEC and FOCI stations and moorings) and as funding allows. Full core monitoring in the ACC may not be fully operational until FY 07.

4.4.7 Candidate Core Variables

The key variables in measuring the productivity of the ACC are temperature, insolation, salinity, fluorescence, and abundance of key forage species, including fish and zooplankton.

4.5 Offshore: Alaska Current and the Subarctic Gyre

4.5.1 Conceptual Foundation for Offshore

In the offshore areas of the Alaska Current and the subarctic gyre, forcing by winds associated with the Alaska Low Pressure (ALP) system has a profound effect on production and shoreward transport of plankton. Production and shoreward transport of plankton are determined by the following:

- Upwelling at the center of the subarctic gyre;
- Depth of the mixed layer (freshwater and solar energy input set up the mixed surface layer where primary production takes place);
- Possible upwelling of nutrients along the continental slope and at the shelf break where the shelf break front may direct upwelled water toward the surface; and
- Formation of eddies along the shelf break that may incubate plankton in a favorable environment for production and be mechanisms of exchange between offshore and shelf water masses. Individual eddies may persist for months and are therefore potentially important in any one growing season.

The contrasts in biological production and shoreward transport of plankton between intense and relaxed ALP conditions in the Alaska Current and the subarctic gyre are profound. In periods with more negative atmospheric pressure

that is keyed by the northeastern movement of the ALP into the GOA in winter, the following interrelated physical changes are observed:

- Acceleration of the cyclonic motion of the Alaska Current and subarctic gyre;
- Increased upwelling in the middle of the subarctic gyre (and possibly along the continental shelf);
- Entrainment of more of the west wind drift (southerly portion of the subarctic gyre) northward into the GOA, rather than into the California Current system;
- Warmer surface-water temperatures and increased precipitation and fresh water runoff from land;
- Freshening of the surface layer;
- Increased winds and Ekman transport; and
- Increased onshore downwelling.

These phenomena are thought to cause the following biological changes:

- The result of the shallower mixed surface layer is that the spring plankton production is likely higher (remember that nutrients may not be limiting in the subarctic gyre);
- Greater standing crops of zooplankton and nekton that have been observed are probably made possible by the higher productivity of the phytoplankton;
- More food is available for the fish that feed on plankton and nekton, such as salmon; and
- Salmon populations track mean atmospheric pressure for the wintertime sea surface on scales of decades.

In addition to the multi-decadal oscillations of atmospheric pressure, climate changes manifested in the northern GOA also include periodic El Niño's and the long-term warming of the oceans. El Niño's have been associated with successful recruitment of a series of groundfish species, such as pollock, as well as some die-off of seabirds. Because the El Niño phenomenon appears to be manifested solely in warming of the upper 200 m of the ocean, its biological effects are probably mediated through water stratification and its relationship to primary production and growth of larval fish.

The Alaska Current is centered over the shelf break, an area of high biological activity. The high concentrations of plankton observed at the shelf break, whether they result from accumulation of plankton originating further offshore, in situ production, or both, provide a rich resource for a variety of organisms and their

predators. It is not clear that juvenile salmon feed in this regime, but adults of all species certainly do. Other prominent organisms include sablefish, myctophids (lantern fish), sea lions, some seabirds, and whales. Well-developed benthic communities exist on the outer shelf, shelf break, and continental slope, including commercially exploited populations of shrimp, crab, cod, halibut, and pollock. Some fishing activities, such as bottom trawling, have the potential to do habitat damage and possibly limit populations of animals associated with the sea bottom. Issues associated with the balance between production and removals of commercially important species are of the utmost societal importance in Alaska and further ecological information, modeling, and synthesis centered on the Alaska Current regime is necessary.

Key Hypothesis: ***Natural forces (such as changes in the strength of the Alaska Current and Alaskan Stream, mixed layer depth of the gyre, wind stress and downwelling) and human activities (such as pollution) play significant roles in determining production of carbon and its shoreward transport.***

4.5.2 Potential Offshore Questions:

a. What is the annual variability in the production of zooplankton in the offshore areas?

   Specific Information Needs: Abundance of zooplankton on time and space scales appropriate to understanding annual production.

b. How are the supplies of inorganic nitrogen, phosphorus, silicon, and other nutrients essential for plant growth in the euphotic zone annually influenced by climate-driven physical mechanisms in the GOA?

   Specific Information Needs: Measurements of inorganic nitrogen, phosphorus, silicon, and other nutrients on time and space scales appropriate to understanding annual variability.

c. What is the role of the Pacific High pressure system in determining the timing and duration of the movement of dense slope water onto and across the shelf to renew nutrients in the coastal bottom waters?

   Specific Information Needs: Synoptic information on sea level pressure and horizontal and vertical structure of density and nutrients on the outer continental shelf and Alaska Gyre in relation to the ACC on appropriate time and space scales.

d. Is freshwater runoff a source of iron and silicon that is important to marine productivity in the offshore and adjacent marine waters?

Specific Information Needs: Levels of biologically available silicon and iron from offshore water in relation to the ACC on appropriate time and space scales.

e. Does iron limitation control the species and size distribution of the phytoplankton communities in the offshore areas?

Specific Information Needs: Levels of biologically available iron and species composition and size distribution of the phytoplankton communities from offshore water on appropriate time and space scales.

4.5.3 Program Implementation

As with the ACC portion of the program, results of GLOBEC research need to be carefully considered before implementation of long-term monitoring in this broad habitat type. This deliberate approach is reflected in the emphasis on synthesis for this habitat type in the early years of the proposed schedule for implementation (Table 4.4).

Table 4. 4 Proposed Implementation Schedule for Offshore Habitat

Fiscal Year	Monitoring Activity		Model	Data Management
	Core	Partners		
2003	Synthesis	Monitor Research	Statistical(c)	Coordination (p)
2004	Synthesis	Monitor Research	Statistical(c)	Coordination (p) Archiving(p)
2005	Synthesis	Monitor Research	Statistical(c) Numerical prototype (p)	Coordination (p) Archiving (p) Distribution (p)
2006	Synthesis	Monitor?	Statistical(c) Numerical (p)	Coordination (p) Archiving (p) Distribution (p)
2007	Synthesis	Monitor?	Numerical (p)	Archiving (p) Distribution (p)

Notes:

c = core (GEM program supported) activity

p = partnership (jointly supported) activity

Prospective partners: NPRB, NOAA (NMFS/NOS), Canadian Department of Fisheries and Oceans (CDFO), Japan Fishery Agency.

Candidate core monitoring activities: GLOBEC stations, Valdez-Long Beach Line, and other ships of opportunity.

Candidate core variables: nutrients, detritus and plankton, temperature, and salinity.

4.5.4 Prospective Partner Activities

Support of partners in existing monitoring projects may be necessary to obtain sufficient information for design of a monitoring program. Because of the expense of initiating most offshore sampling programs, careful selection of partners and the use of long-term, low-frequency data gathering will be key strategies for understanding decadal-scale changes in this environment. Current efforts to apply the continuous plankton recorder (CPR) technology on ships of opportunity in the GOA offer partnership opportunities. Extension of existing ships of opportunity programs to include measurement of variables of interest to the GEM program is also a possibility.

4.5.5 Models

The GLOBEC NPZ 1-D and 3-D models are discussed above in Section 4.4.5. A broader model addressing NPZ for the entire North Pacific is the North Pacific Ecosystem Model for Understanding Regional Oceanography (NEMURO), in which fluxes of nitrogen, silicon, and carbon will be tracked (see Appendix E).

4.5.6 Candidate Core Monitoring Activities

A reasonable oceanographic program in the ACC can probably be extended across the shelf break with the use of existing GLOBEC, FOCI, and OCC sampling stations, moorings, and transects. The use of the Valdez-Long Beach line with oil tanker-mounted fluorescence and zooplankton sampling gear appears to be an attractive methodology for long-term, low frequency sampling over large spatial scales.

4.5.7 Candidate Core Variables

Particularly crucial aspects of the offshore environment are physical processes and attendant biological responses at the shelf break and front (for example, extent of deep-water intrusion onto the shelf in the late summer and fall); the mixed layer depth in the Alaska Gyre in the spring-summer; and Ekman transport of offshore production onshore. Measurements of basic variables are essential to understanding the role of these offshore aspects in affecting productivity of other habitats. These variables include temperature, salinity, nutrients, detritus, and plankton.

4.6 Conclusions: Moving the GEM Program Forward

To maintain the value of the long-term monitoring program, data collection and sampling protocols will necessarily be conservative, changing only with demonstration of substantial need, and then only after careful deliberation. Therefore, it is critical that GEM chose its monitoring projects with caution and deliberation . The process envisioned will select research projects in

the early years of the program that show promise of leading eventually to inclusion in the long-term monitoring program. Research will be focused around initial research questions developed through the Scientific and Technical Advisory Committee (STAC) and subcommittee processes (see Chapter 5), using the questions provided in this chapter as a starting point for deliberation. In the initial years of the program, research projects will be selected through a solicitation process. The Trustee Council will issue the request for proposals with recommendations from the Scientific and Technical Advisory Committee, the Public Advisory Committee and community involvement (See Chapter 5). As the GEM Program matures, requests for proposals may become increasingly targeted toward requests for specific research and monitoring projects and capabilities. However, a portion of the available funds will continue to be allocated to the innovative synthesis and research proposals necessary to maintain high standards of scientific rigor and cost effectiveness. Workshops and subcommittees will be important mechanisms to involve the public, including resource managers, communities and other stakeholders, in selecting research and monitoring activities.

4.7 References

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Bogard, S.J., P.J. Stabeno, and J.D. Schumacher. 1994. A census of mesoscale eddies in Shelikof Strait, Alaska during 1989. Journal of Geophysical Research 99: 18243-18254.

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Eslinger, D., R.T. Cooney, C.P. McRoy, A. Ward, T. Kline, E.P. Simpson, J. Wang, and J.P. Allen. 2001. Plankton dynamics: observed and modeled responses to physical factors in Prince William Sound, Alaska. Fisheries Oceanography 10 (Suppl. 1): 81-96.

Finney, B.P., I. Gregory-Eaves, J. Sweetman, M.S.V. Douglas, and J.P. Smol. 2000. Impacts of climatic change and fishing on Pacific salmon abundance over the past 300 years. Science 290: 795-799.

5. PROGRAM MANAGEMENT: ADMINISTRATION, PUBLIC & COMMUNITY ADVICE & INVOLVEMENT, SCIENTIFIC GUIDANCE, AND DATA POLICIES

In This Chapter

- Program administration
- Discussion of a reconstituted Public Advisory Committee and other ways to provide for community advice and involvement
- Description of the process for providing scientific advice, review and management
- Establishment of data management office and policies

5.1 Administration

The administration and management of the GEM program must be cost-efficient, have a high degree of scientific credibility, and provide for public access and accountability.

The GEM program will be administered by a core professional staff that is not directly affiliated with any particular agency, institution, or program. This is currently the case with the management of the *Exxon Valdez* Oil Spill Trustee Council Office (Figure 5.1). An executive director will oversee the financial, program management and administrative, scientific, and public involvement aspects of the program. The executive director and staff, while housed for administrative purposes in a single government agency, will work under a cooperative agreement for all six trustees. The Trustee Council and staff will actively solicit advice on science and policy matters, including review of monitoring and research activities, from experts, including the Scientific and Technical Advisory Committee, and from the public, including the Public Advisory Committee.

5.1.1 The Work Plan

A Work Plan will document the current activities that implement the program. As projects for monitoring and research are approved by the Trustee Council, they will become part of the Work Plan. The Trustee Council may be asked to adopt a new Work Plan each year, or they may be asked to adopt new groups of projects into the Work Plan on a periodic basis.

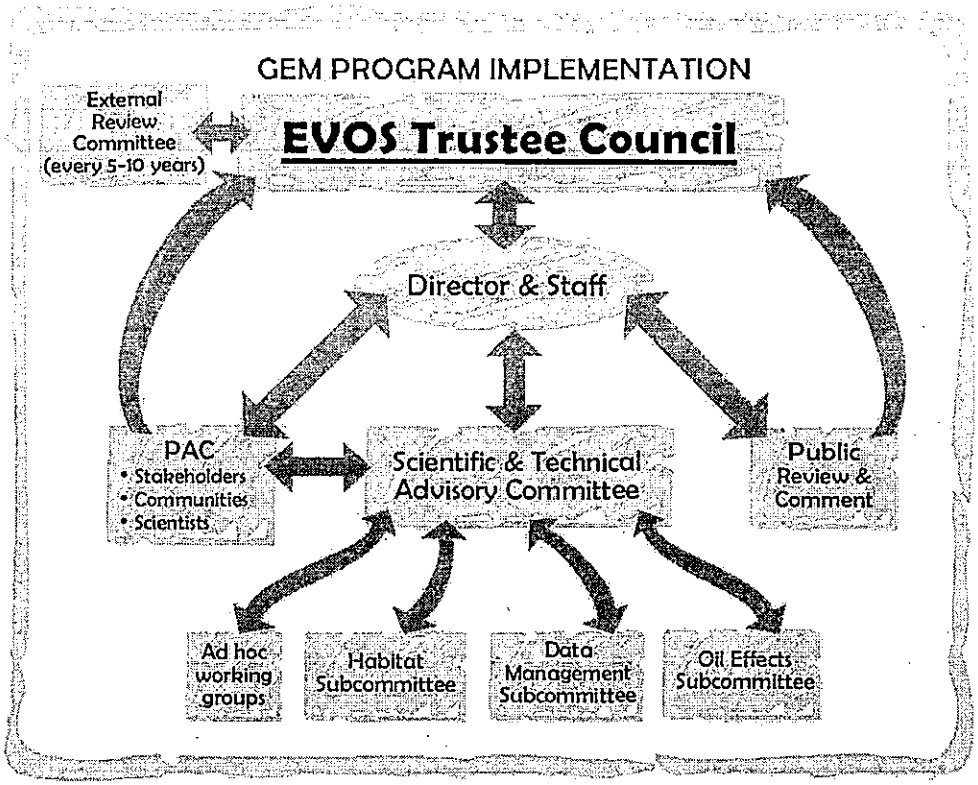

Figure 5.1. The organizational elements involved in GEM implementation. Modified in response to comments from the NRC, after GEM Program Document, Vol. I, Chapter 6, page 66.

5.1.2 Proposal Development & Evaluation Process

The proposal development and evaluation process will have the following elements or steps, which are also shown in Figure 5.2. As implementation of the GEM program begins, however, these steps may be modified as efficiencies and improvements are found.

- A "State of the Gulf" workshop will be held periodically, at which the current status of the health of the GOA ecosystem will be assessed. Project investigators, peer reviewers, resource managers, stakeholders, and the public will be invited to this meeting, at which research and monitoring results will be presented and discussed. In some years, this workshop will be replaced by or augmented with a process of consultations and workshops with various committees and work groups of science and public advisors to evaluate and affirm or revise priorities.
- An *Invitation to Submit Proposals*, which will specify the types of proposals that are priorities for consideration to implement the mission and goals of the GEM program, will be issued periodically. Research proposals are envisioned to be of finite duration and have short-term goals (for example,

2 to 5 years). Monitoring projects will be evaluated and renewed on longer time scales (such as once every 5 years). The *Invitation(s)* will be the vehicle for notifying the scientific community, the public and others that proposals will be considered during a certain period of time.

- Proposals received in response to the *Invitation* will be circulated for technical peer review (see below). In addition, proposals will be reviewed by the STAC and appropriate subcommittees for their ability to contribute to the information-gathering needs of the central hypothesis and questions, and also for how they contribute to meeting the programmatic goals and strategies of the Trustee Council (see Chapters 1 and 3), such as promoting community involvement, developing resource management applications, and leveraging funds from other sources. Past performance of principal investigators will be assessed. Staff will also review all budgets.
- Comments from the PAC and the general public will be solicited. A reasonable period of time for public comment will be built into the review process.
- The executive director will present to the Trustee Council the recommendations of the STAC and PAC, a summary of any additional public comment, and additional recommendations if appropriate.

The Trustee Council, after receiving advice from its public and scientific advisors and staff, will vote on which proposals to fund.

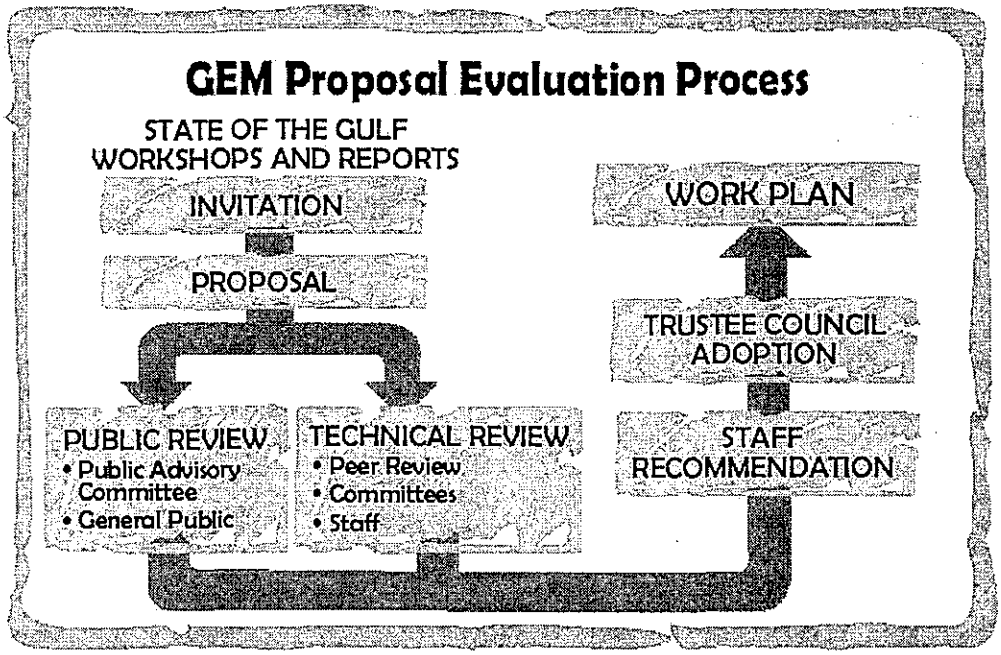

Figure 5.2 GEM Proposal Evaluation Process

5.1.3 Reports and Publications

Annual and final reports will be required for all projects, following established procedures. To ensure that investigators are making satisfactory progress toward project objectives, staff will review annual reports. In addition, annual reports may possibly be sent out for independent peer review. Final reports will be subject to independent peer review, and comments from the independent peer reviewers must be addressed in the final versions of final reports. All final reports will be archived at the Alaska Resources Library and Information Service (ARLIS) and available on the Trustee Council's web page.

Publications in the peer-reviewed literature will be expected of program participants.

5.1.4 Peer Review

Each project, as well as some annual and all final reports, will be peer-reviewed by appropriate experts identified by staff who, as a rule, are not also conducting projects funded by the Trustee Council. The peer review may be either paid or volunteer, whichever is most expeditious and appropriate. The external peer review process will provide a rigorous critique of the scientific merits of all monitoring and research proposals and selected reports. Review functions may be carried out in writing, by telephone and occasionally on site or in person.

Special review panels may be convened from time to time to evaluate and make recommendations about aspects of the GEM program. At other times, special panels may meet with project investigators and others to fully explore particular topics, problems, or projects.

5.1.5 External Program Review

The Trustee Council is committed to review of the program by an outside entity, such as the National Research Council, at periodic intervals. This review will look at the program's structure and implementation to ensure that the GEM mission and goals are being achieved.

5.2 Public and Community Advice and Involvement

The importance of public participation in the Trustee Council process, as well as establishment of a public advisory group to advise the trustees, was specifically recognized in the *Exxon Valdez* settlement and is an integral part of the agreement between the state and federal governments.

The Trustee Council is committed to public input and public outreach as vital components of the long-term GEM program. Figure 5.1 illustrates the role of public participation in the GEM program.

5.2.1 Public Advisory Committee

The Public Advisory Group (PAG) in effect from 1991 - 2002 has 17 members representing 12 interest groups and the public at large, as well as two ex-officio members from the Alaska Legislature. The charter for a new Public Advisory Committee (PAC) will be certified in September 2002. The PAC will consist of 20 members, representing 14 distinct public interests. The PAC will meet at least twice a year to provide broad program and policy guidance to the Trustee Council and staff on the overall development and progress of the GEM program. The group will take an active role in setting priorities and ensuring that the overall program is responsive to public interests and needs.

5.2.2 Public Advice

The Public Advisory Committee is not the only source of public advice for the Trustee Council. Opportunities for public advice and comment are incorporated throughout the process. The Trustee Council is a public entity subject to the State of Alaska Open Meetings Act and corresponding federal laws. All meetings are public, noticed to the public, and include a formal public comment period. Newsletters, annual reports, public meetings in communities in the spill-affection region, and the Trustee Council's Web site (www.oilspill.state.ak.us) are all tools to promote and encourage public input and participation.

5.2.3 Public and Community Involvement

The Trustee Council is committed to incorporating public and community involvement in the GEM program at all levels. This means not just providing advice on proposals and policies, but involving communities early on in developing research hypotheses and questions and helping decide what variables to monitor and in what locations.

Developing a program that includes extensive community involvement will be a challenge, and will necessarily evolve over time. The Trustee Council is funding several planning projects in FY 2002-2003 to further develop ways to better incorporate local and community involvement in the GEM program.

Ongoing efforts include, but are not limited to, these elements:

- Community meetings where community members are asked to provide information on what issues and questions are most important to them.
- Public, stakeholder and community membership on the Public Advisory Committee. Expansion of the committee size to allow greater participation by communities and stakeholders.
- Community representation on all subcommittees and work groups used in developing and implementing the GEM program. Making funding available to encourage participation in subcommittees and work groups.

- Joint meetings between the Scientific and Technical Advisory Committee and the Public Advisory Committee to foster communication between scientific interests and community interests.
- Membership of at least one STAC member on the PAC.
- A proposal solicitation and review process that encourages community-based proposals.
- The inclusion of community-based monitoring programs and traditional knowledge in the GEM Program, especially in the watershed and intertidal/subtidal habitats.

5.3 Scientific Advice, Review & Management

In addition to peer review of individual proposals and public review and advice, a committee and work group approach will be used to guide GEM program development and implementation.

5.3.1 GEM Science Director

The GEM Program Science Director will work closely with other scientific advisory bodies, and will be the staff member tasked with overseeing implementation of the science program and informing interested communities of the program's results. The Science Director will work with other Trustee Council staff in overseeing implementation of research and monitoring activities, ensuring timely delivery and dissemination of research results, and maintaining the GEM database. The Science Director makes recommendations to the Executive Director and the Trustee Council on program implementation and development.

5.3.2 Scientific and Technical Advisory Committee (STAC)

The STAC is a standing committee that is expected to provide the primary scientific advice to the Executive Director on how well the collection of proposed monitoring and research projects (the work plan) and the GEM Program meet the mission and goals of the program and test the conceptual foundation.

The STAC has three primary functions:

1. Provide leadership in identifying and developing testable hypotheses relevant to the conceptual foundation of the GEM plan, consistent with the mission, goals and policies of the Trustee Council.
2. Make recommendations to the Executive Director and GEM Science Director on preparation of the science program and implementation plans; proposal solicitation and peer review; and selection of research, monitoring, synthesis, modeling and other studies best suited to meeting the goals of the GEM program.

3. Provide support and oversight to subcommittees and ad hoc work groups as needed (see below).

The STAC is composed of emeritus and senior scientists and others selected primarily for their broad expertise and leadership who serve for four-year, staggered renewable terms. At least one of the scientists serving on the STAC also serves on the PAC. The STAC members are not principal investigators for GEM projects. Institutional and professional affiliations are of interest in selecting members, because connections to other marine science programs are valuable for ensuring collaboration and coordination on GEM program implementation. The GEM Science Director is a co-chair and non-voting member of the STAC.

5.3.3 Subcommittees

Subcommittees are standing committees organized to address specific aspects of the GEM program, to facilitate coordination among scientists, resource managers, and the public and communities, and to help the STAC provide leadership and oversight for the program.

The functions of the subcommittee(s) are to:

- Recommend to the STAC testable hypotheses, items for invitation and peer reviewers;
- Identify and help guide implementation of core monitoring stations and variables that are relevant to the key questions and testable hypotheses;
- Advise on, or possibly convene special review panels or work groups about, aspects of the GEM program.

The subcommittees are composed of scientists, resource managers, educators, and community members selected for knowledge, expertise or familiarity with the issue around which the subcommittee is created. For example, subcommittees could be developed around each of the broad habitat types (watersheds, intertidal and subtidal, ACC, and offshore) or just one overall habitat, lingering oil effects, data management systems and information technology, modeling, monitoring or other GEM program areas. Subcommittee members can be principal investigators on current GEM funded projects. Institutional, professional, and other affiliations will also be of interest in selecting members to promote collaboration and cooperation.

5.3.4 Work Groups

The STAC and subcommittees may periodically form ad hoc work groups to develop specific products as requested. Work groups could also be charged with solving a particular problem in a finite amount of time, such as the proper location of an oceanographic mooring.

5.3.5 Workshops

The STAC or subcommittees may recommend organizing workshops to provide input on core variables for monitoring, research activities, community involvement strategies, and other program elements. The GEM Program anticipates that workshops will play an important role in implementing the science program and disseminating the results of GEM research to resource managers and communities.

5.4 Data Management and Information Transfer

The Data Management Office will be an essential component of the GEM Program. The office will be headed by a Data Systems Manager who will evaluate continuously the evolving information management needs of the GEM program, and identify and recommend cost-effective solutions to the Executive and Science directors. Over time the mix of in-house supporting staff and out-sourced tasking may vary, but there will be a long-term commitment to providing consistent and high quality data management support (data quality, archive, and analysis) to the GEM program. Staff in the Data Management Office will coordinate with other agencies in regard to data management and information transfer, manage computing resources, develop software programs, and maintain web sites in support of the GEM program. In addition, staff in the Data Management Office will be responsible for developing and ensuring compliance with data policies and procedures.

Data management and information transfer policies are an integral part of GEM program management. Clear and effective approaches for information gathering, archiving and dissemination are essential to the successful operation of a long-term ecosystem science project such as the GEM program. Because the GEM program is regional in geographic scope, with goals of cooperation, coordination, and integration with existing marine science programs, data management and information transfer policies are to be compatible with, and similar to, existing norms for state, federal, and nongovernmental marine science programs. Whenever possible, existing norms will be adapted or adopted for use by the Trustee Council. Standards adopted by the Federal Geographic Data Committee (FGDC), GLOBEC, and the EPA's Environmental Monitoring and Assessment Program (EMAP), and other organizations will be considered for developing GEM data management and information transfer policies. (Options and procedures for data management and information transfer are considered in more detail in Chapter 9.)

The GEM data management and information transfer policies will incorporate the following broad elements:

- A commitment to making data and models available in a well documented and understood form.

- Full and open sharing of data and models at low cost, after verification and validation.
- Timely availability of data and models.
- Acceptance of and adherence to the data policies as a condition for participation in the GEM program and receipt of funding.
- Adherence to data collection and storage standards.
- Availability of data and models on the GEM public Web site, or through a national public archive.
- Long-term archiving of all data and models in a designated storage facility.
- Proper metadata, including identification of the origin of all data and models with a citation.

Exxon Valdez Oil Spill Trustee Council

441 W. 5th Ave., Suite 500 • Anchorage, Alaska 99501-2340 • 907/278-8012 • fax 907/276-7178

AGENDA
EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
MEETING
July 9, 2002 10:30 a.m.
441 West 5th Ave., Suite 500, ANCHORAGE

DRAFT

Trustee Council Members:

CRAIG TILLERY
Assistant Attorney General
State of Alaska

MICHELE BROWN
Commissioner
Alaska Department of
Environmental Conservation

DRUE PEARCE
Senior Advisor to the Secretary
for Alaskan Affairs
U.S. Department of the Interior

MARIA LISOWSKI for
DAVE GIBBONS
Forest Supervisor
Forest Service Alaska Region
U.S. Department of Agriculture

JAMES W. BALSIGER
Administrator, Alaska Region
National Marine Fisheries Service

FRANK RUE
Commissioner, Alaska
Department of Fish & Game

Teleconferenced in Anchorage, Restoration Office, 441 W 5th Ave, Suite 500
_____Federal Chair

1. Call to Order - 10:30 a.m.
   - Approval of Agenda*
   - Approval of Meeting Notes*
     June 14, 2002

2. Executive Director's report

3. Public comment - 10:45 a.m.

4. Approval of the GEM Program Document*

5. Approval of the Revised Operating & Report Procedures*

6. Executive Session - 12:00 p.m. - 1:30 p.m.

7. Approval of the New Trustee Council Data Policy*

8. Update on Status of Injured Resources and Services*

9. Habitat Protection
   - Report from Grantee
     - Randy Hagenstein, The Nature Conservancy
     - Glenn Elison, The Conservation Fund
   - Small parcel KAP 1087/Chokwak*
   - Sitkalidak Land Exchange equalizing payment*

Adjourn - 3:00 p.m.

* Indicates tentative action items.

DRAFT

Exxon Valdez Oil Spill Trustee Council

441 W. 5th Ave., Suite 500 • Anchorage, Alaska 99501-2340 • 907/278-8012 • fax 907/276-7178

TRUSTEE COUNCIL MEETING NOTES

Anchorage, Alaska
June 14, 2002

By Molly McCammon
Executive Director

Trustee Council Members Present:

Dave Gibbons, USFS
Drue Pearce, DOI
James Balsiger, NMFS
Frank Rue, ADF&G
•Michele Brown, ADEC
*Craig Tillery, ADOL

* Chair
In Anchorage: Gibbons Pearce, Balsiger, Klein and Tillery
By teleconference: Rue

•Alternates
Ron Klein served as alternate for Michele Brown for the entire meeting.
Jim Balsiger joined the meeting at 10:12 a.m.

Meeting convened at 10:05 a.m., June 14, 2002, in Anchorage.

1. Approval of the Agenda

APPROVED MOTION: Approved the June 14, 2002 agenda (Attachment A)

Motion by Pearce, second by Klein.

2. Approval of Meeting Notes

APPROVED MOTION: Approved April 18, 2002 meeting notes (Attachment B).

Motion by Pearce, second by Klein.

Public comment period began at 10:16 a.m.

Public comments received from six individuals, five in Anchorage, one on-line from Homer (at 1:45 p.m. to 1:47 p.m.). **Five of these comments were on the Draft Update on Injured Resources.**

Public comment period closed at 11:15 a.m.

3. Old Harbor Land Exchange

APPROVED MOTION: Approved a motion to delete the requirement that the Old Harbor Native Corporation convey a conservation easement on Sitkalidak Island to the United States Fish and Wildlife Service, imposed as a condition upon the funding provided for the Sitkalidak land exchange.

Motion by Pearce, second by Rue.

4. PAC Charter Revisions

APPROVED MOTION: Approved a motion to add revisions to the following sections of the PAC Charter: Membership, Selection and Service; Expenses; Authority (Attachment C), and replace the references to "Program Advisory Committee" with "Public Advisory Committee" and adopt the June 4, 2002 draft PAC Charter.

Motion by Pearce, second by Rue.

BREAK
Off the record at (11:58 a.m.)
On the record at (12:06 p.m.)

5. GEM

DISCUSSION: Discussion concerning revisions to the GEM Program Document. The GEM Program Document is to be presented to the Trustee Council for approval at the July 9, 2002 Trustee Council meeting.

6. NRC Report

BRIEFING: Mike Roman, chair of the National Research Council's review committee, briefed the Trustee Council on the committee's final report on GEM (Attachment D).

BREAK
Off the record at (12:50 p.m.)
On the record at (1:05 p.m.)

7. Procedures and Policies

DISCUSSION: Discussion on the proposed changes to the Trustee Council's Procedures (Attachment E). The proposed revisions are to be presented to the Trustee Council for action at the July 9, 2002 meeting.

8. FY 03 Draft Phase II Invitation

BRIEFING: The Trustee Council was briefed on the draft FY 03 Phase II invitation. Phase I recommendations (approximately $4 million) are currently out for public review. The Trustee Council will act on them on August 6, 2002. The Phase II invitation is scheduled to be issued on July 15, 2002 with proposals due on September 4, 2002.

Meeting adjourned 2:01 p.m.

Motion by Balsiger, second by Pearce.

Exxon Valdez Oil Spill Trustee Council

441 W. 5th Ave., Suite 500 • Anchorage, Alaska 99501-2340 • 907/278-8012 • fax 907/276-7178

MEMORANDUM

TO: Trustee Council

FROM: Molly McCammon
Executive Director

RE: Proposed Revisions to Trustee Council's Procedures

DATE: June 27, 2002

This memo summarizes the substantive changes made to the proposed procedures since you reviewed them at your June 14, 2002 meeting.

General Operating Procedures
p. 2, Trustee Council #4
Provide for chair to alternate meeting-to-meeting between state and federal trustees.

p. 4, Proposal Solicitation & Review #5
Allow for Trustee Council to approve funding a project for a single year or for multiple years.

Financial Procedures
No substantive changes.

Report Writing Procedures
pp. 11 & 12, Final Report Reproduction and Number of Copies
Reduce number of copies of final report that must be submitted from 31 to 21 (based on reduction in number of libraries requesting paper copies of reports).

p. 14, Annual Report Due Date
Require annual reports to be submitted earlier than currently (September 1 rather than April 15) so that they can be more directly relied on for decisions on continued funding.

p. 15, Distribution of Annual Reports
Specify that annual reports will be posted on the Trustee Council's website.

Att. B, Annual Report Form
Revise annual report elements to better reflect proposal elements.

Data Policy

p. 3, Data Preservation

Add a clear reference to the Trustee Council's document and physical evidence destruction procedure.

pp. 3 & 4, Data Submission to the GEM Archive & Data Dissemination

Add discussion on data that will be made available in real or near-real time.

INTRODUCTION

1. *Purpose.* Define the Policies and Procedures of the *Exxon Valdez* Oil Spill Trustee Council (Trustee Council) and provide guidance regarding the authorities and responsibilities of entities that receive funds approved by the Trustee Council.

2. *Supersession.* These procedures supersede the Procedures adopted by the Trustee Council August 3, 2000 and August 29, 1996, the Operating Procedures adopted by the Trustee Council January 10, 1992, and the Financial Operating Procedures adopted by the Trustee Council September 21, 1992.

3. *Relationship.* The Procedures of the Trustee Council augment state and federal procedures. State and federal agencies receiving funds approved by the Trustee Council are responsible for ensuring that the procedures described in this document and the appropriate state or federal procedures are followed.

4. *Amendments.* These procedures may be modified by unanimous agreement of the Trustee Council.

5. *Authority.* The principles and processes stated herein are established pursuant to the Memorandum of Agreement and Consent Decree entered as settlement of United States of America v. State of Alaska, No. A91-081 Civil, U.S. District Court of Alaska. The Joint Trust Fund is comprised of all payments received in settlement of State of Alaska v. Exxon Corporation , el al., No. A91-083 CIV, and United States of America v. Exxon Corporation , el al., No. A91-082 CIV.

6. *Restoration Plan.* The *Exxon Valdez* Restoration Plan provides long-term guidance for restoring the resources and services injured by the 1989 *Exxon Valdez* oil spill. It contains policies for making restoration decisions and describes how restoration activities will be implemented. The Restoration Plan was adopted by the Trustees in November 1994 after completion of the Final Environmental Impact Statement. By unanimous consent, the Trustee Council may change the plan if the Trustee Council determines that the plan is no longer responsive to restoration needs.

GENERAL OPERATING PROCEDURES

TRUSTEE COUNCIL

1. *Basic Governing Procedures.* The current edition of *Roberts Rules of Order* will govern the Trustee Council. All provisions of these rules of order will apply to Trustee Council deliberations unless the Trustee Council unanimously decides to proceed differently.

2. *Trustee Council Membership.* The following officials act on behalf of the public as trustees: the Attorney General of the State of Alaska; the Commissioner of the Alaska Department of Environmental Conservation; the Commissioner of the Alaska Department of Fish and Game; the Secretary of the United States Department of Agriculture; the Secretary of the United States Department of the Interior; and the Administrator of the National Oceanic and Atmospheric Administration, United States Department of Commerce. Each Trustee may designate a representative to serve on the Trustee Council. Any such designation shall be in writing and the designation shall be maintained in the official record. In the event a Trustee Council member is precluded from attending a meeting or must be excused during a meeting, an alternate may exercise voting privileges on behalf of the Trustee Council member. Alternates shall be designated in writing and the designation shall be maintained in the official record or an alternate may be identified at the meeting and so stated for the record.

3. *Quorum.* A quorum of two-thirds (2/3) of the total Trustee Council membership including at least two state members and two federal members shall be required to convene a meeting. All decisions shall be made by unanimous agreement of the six Trustee Council members, their designee or their alternate, except that a quorum may approve the agenda, take public testimony and adjourn a meeting.

4. *Chair.* The Trustee Council shall designate a chair to preside at each meeting. The chair shall alternate meeting-to-meeting between the state and federal trustee members. The chair may participate in discussion and debate at the meetings and shall vote on all questions before the Trustee Council.

5. *Trustee Council Action.* All matters before the Trustee Council which require a vote, make a recommendation, approve or disapprove an item, or otherwise render a decision shall require the unanimous agreement of the six Trustee Council members, their designee or their alternate. All actions by the Trustee Council shall be taken at duly convened meetings except as provided in Section 10, Emergency Action.

6. *Recusal.* In the event a Trustee Council member believes he or she must recuse himself or herself from voting, the Trustee Council member may request the decision be deferred until a designated alternate is available to vote.

7. *Meetings.* Meetings shall be held at times and locations determined by the Trustee

Council. The Executive Director shall provide a proposed agenda and appropriate briefing materials to the Trustee Council members in advance of the meeting. The final agenda for the meeting will be determined by the Trustee Council and shall include a reasonable opportunity for public comment.

8. *Executive Sessions*. Executive sessions shall be kept to a minimum and shall be used only for discussion of matters concerning confidential personnel issues, litigation or legal advice, habitat acquisition negotiations, confidential archaeological information, confidential fisheries information or other matters included under AS 37.14.430, AS 44.62.310 (c) or other applicable State or Federal laws.

9. *Minutes of Trustee Council Meetings*. All meetings shall be recorded electronically or by a court reporter, and said records shall, along with the written, approved meeting notes, constitute the official record of the Trustee Council's actions.

10. *Emergency Action*. In the event of an emergency requiring Trustee Council action before a meeting can be held in accordance with the procedures described herein, the Executive Director shall poll the Trustee Council and take action by unanimous agreement. Any decisions of the Trustee Council shall be reflected in the official record of the Trustee Council along with justification regarding the need to take emergency action. In addition, any emergency action taken shall be ratified at the next meeting of the Trustee Council.

ORGANIZATIONAL STRUCTURE

1. *General*. Pursuant to the agreement between the State of Alaska and the United States, the Trustee Council has created the position of Executive Director to manage the day-to-day administrative functions of the Trustee Council and the overall restoration program.

2. *Trustee Council Office*. Under supervision of the Executive Director, the Trustee Council Office is responsible for: (1) facilitating communication between the federal and state governments, the Trustee Council members, the Scientific and Technical Advisory Committee, and the Public Advisory Committee; (2) maintaining the official record of the Trustee Council's actions; (3) soliciting project proposals and administering the proposal process, including supporting the Scientific and Technical Advisory Committee and any additional subcommittees and working groups that are formed to advise on the scientific development of the program; (4) preparing and analyzing financial and project status information; (5) developing and implementing procedures to achieve the goals and objectives of the Trustee Council; (6) performing and/or overseeing special and ongoing projects; and (7) public outreach and public participation.

3. *Trustee Agencies*. Under supervision of the agency's Trustee Council member, each Trustee agency is responsible for administrative oversight of projects funded to or through their agencies. This oversight shall include (1) ensuring that the procedures described herein, and the

appropriate state or federal procedures, are followed, including compliance with the National Environmental Policy Act and (2) ensuring that projects funded meet their stated objectives and schedules, and are accomplished consistent with the funds authorized.

PROPOSAL SOLICITATION AND REVIEW

1. *Invitation.* At least annually the public, private sector, non-profit groups, and government agencies will be invited to submit proposals for funding based on identified restoration priorities and needs.

2. *Review.* Proposals received will be subject to independent scientific review, as well as policy, budget, and legal review. Based on these reviews, the Executive Director shall make a recommendation to the Trustee Council on which proposals should be funded.

3. *Public Review and Comment.* Prior to Trustee Council action, a reasonable period of time shall be provided for the public to review and comment on the project proposals.

4. *Approval.* After expiration of the period for public review and comment, the Trustee Council, in open session and with additional opportunity for public comment, shall review the Executive Director's recommendation on which proposals should be funded. The Trustee Council may make changes to the recommendation or include terms and conditions of funding as the Trustee Council deems appropriate. Upon unanimous approval, the recommendation shall be adopted by the Trustee Council.

5. *Multi-Year Projects.* For multi-year projects, the Executive Director's recommendation shall include the number of years of funding to be provided for each project. The Trustee Council may approve funding a project for a single year or for multiple years.

PROJECT REPORTS

1. *Quarterly Project Status Reports.* Within thirty days following the end of each quarter, the investigator for each project approved by the Trustee Council shall submit a status report to the Executive Director. The report contents, format, and review procedures shall be determined by the Executive Director.

2. *Annual Project Reports.* Annually, the investigator for each continuing project approved by the Trustee Council shall submit a report to the Executive Director. A continuing project is one that was initiated with the expectation that it was multi-year. The report deadline, contents, format, and review procedures shall be determined by the Executive Director. A copy of each report shall be placed in the Trustee Council's official record.

3. *Final Project Reports.* Upon completion of each project approved by the Trustee Council, or a determination by the Trustee Council to no longer fund a project, the investigator

shall submit a report to the Executive Director. The report deadline, contents, format, and review procedures shall be determined by the Executive Director. A copy of each report shall be placed in the Trustee Council's official record and at ARLIS (Alaska Resources Library & Information Services).

PROJECT DATA

1. Metadata and Data. During the course of the project and at its completion, the investigator shall submit metadata ("data about data") and project data according to Trustee Council approved data policies. The metadata and project data contents, format, and review procedures shall be determined by the Executive Director.

HABITAT PROTECTION AND ACQUISITION

1. *General.* Habitat Protection and Acquisition is an important means of restoring injured resources and the services that are dependent upon those resources. Habitat Protection and Acquisition may include the purchase of lands or interests in land such as conservation easements, mineral rights, or timber rights.

2. *Parcel Nomination.* Only those parcels nominated by a willing seller shall be considered for purchase. The Executive Director shall prepare and maintain written procedures regarding nomination of parcels.

3. *Parcel Evaluation.* Nominated parcels shall be evaluated based on their importance to the conservation and protection of marine and coastal resources, ecosystems, and habitats in order to aid in the overall recovery of, and to enhance the long-term health and viability of, those resources injured by the oil spill and the spill area ecosystem.

4. *Terms and Conditions.* By unanimous agreement of the six Trustees, their designee or their alternate, a resolution shall be adopted authorizing the purchase of land or ownership rights. The resolution shall set forth the terms and conditions appropriate for the identified parcel(s).

5. *Title and Management.* The title of any lands or ownership rights shall be specified in the resolution adopted by the Trustee Council. All land acquired shall be managed in accordance with the terms and conditions of the Trustee Council.

6. *Public Review and Comment.* Prior to final Trustee Council action, reasonable public notice shall be given and the public shall be provided an opportunity to comment.

7. *Application or Notification for Disbursement.* Upon certification from the Executive Director that the terms and conditions set forth in a resolution have been satisfied, the Alaska Department of Law and the United States Department of Justice shall be requested to provide

notice to the United States District Court for the District of Alaska regarding the expenditure of funds. Concurrently, as appropriate, the Executive Director shall provide the custodian of the Investment Fund(s) with payment instructions.

PUBLIC PARTICIPATION

1. *General.* The Trustee Council recognizes that public participation in the restoration program is an integral part of the process. To that end, the public is invited to review, comment on and participate in the development and implementation of the restoration program.

2. *Exxon Valdez Oil Spill Public Advisory Committee.* By order of the District Court for the District of Alaska, the Public Advisory Committee is to advise the Trustees, appointed to administer the fund established in settlement of United States v. Exxon Corporation, Civil Action No. A91-082, and State of Alaska v. Exxon Corporation, Civil Action No. 091-083, both in the United States District Court for the District of Alaska, in all matters described in Paragraph V.A.1 of the MOA referenced above. The overall procedures for the Public Advisory Committee are contained in a Charter unanimously approved by the Trustee Council and signed by the Secretary of the United States Department of the Interior. The Public Advisory Committee consists of members recommended by the Trustee Council and appointed by the Secretary of the United States Department of the Interior.

3. *Public Notice.* Reasonable public notice shall be given for all meetings of the Trustee Council. The notice shall include, when possible, publication in one or more newspapers of general circulation in the following communities: Anchorage, Cordova, Homer, Juneau, Kenai, Kodiak, Seward, and Valdez and distribution of the public notice to radio stations broadcasting to these communities as well as in Chenega Bay, Tatitlek, Whittier, Seldovia, Port Graham, Nanwalek, and Kodiak area villages. To the maximum extent possible, reasonable public notice shall also be provided to other communities within the spill area. The public notice shall identify the purpose of the meeting and include a reasonable opportunity for public comment.

4. *Access to Information.* Except where documents are confidential under state or federal law, the public shall have access to the official record of the Trustee Council's actions and information regarding proposed or completed projects or other activities funded by the Trustee Council.

b. FINANCIAL

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
FINANCIAL PROCEDURES

SETTLEMENT FUNDS

1. *Joint Trust Funds.* The Joint Trust Funds consist of all payments received or to be received by the United States and the State of Alaska pursuant to the Agreement and Consent Decree issued in United States v. Exxon Corporation, et al. (No. A91-082 CIV) and State of Alaska v. Exxon Corporation, et al. (No. A91-083 CIV), including any interest accrued thereon.

2. *Court Registry Investment System.* Pursuant to Court Order and in accordance with the Terms of the Memorandum of Agreement and Consent Decree, from December 1991 through October 5, 2000, the Joint Trust Funds were placed in an interest-bearing account in the Court Registry Investment System (CRIS) administered through the United States District Court for the Southern District of Texas. The CRIS established two accounts – the *Exxon Valdez* Oil Spill Settlement Account and the CRIS – *Exxon Valdez* Reserve Fund to receive and hold the Joint Trust Funds. Although the Joint Trust Funds were moved in October 2000 from the Court Registry System to the Alaska Department of Revenue, Division of Treasury, the Court Registry Investment System is still an investment option for the Trustee Council.

3. *Investment Fund(s).* The Governments sought and obtained Congressional approval to expand options for investment of the settlement proceeds. Public Law 106-113, the Consolidated Appropriations Act, 2000, was enacted November 29, 1999. Section 350 of H.R. 3423, authorizes deposit of all or a portion of the Joint Trust Funds previously received, or to be received, by the Governments in the Natural Resource Damage Assessment and Restoration Fund or accounts outside the United States Treasury or both. See section on Investment Fund.

4. *CRIS Disbursement.* Upon joint application of counsel for the United States and the State of Alaska, the United States District Court for the District of Alaska orders the disbursement of funds for purposes consistent with the Memorandum of Agreement and Consent Decree. The joint application shall consist of legal documents required by the Court and documentation demonstrating the unanimous agreement of the Trustee Council. When appropriate, interest earned on the federal and state accounts and/or unobligated balances from prior years' Work Plans shall be subtracted from the disbursement.

5. *Investment Fund(s) Disbursement.* Upon unanimous approval of the Trustee Council, the Alaska Department of Law and the United States Department of Justice shall be requested to notify the United States District Court for the District of Alaska. The notification shall consist of legal documents required by the Court and documentation demonstrating the unanimous agreement of the Trustee Council. Concurrently, the Alaska Department of Law and the United States Department of Justice shall be requested to provide the custodian(s) of the Investment Fund(s) with payment instructions. When appropriate, interest earned on the federal and state

accounts and/or unobligated balances from prior years' authorizations shall be subtracted from the disbursement.

6. *Authority to Spend.* No obligations shall be incurred until such time as a Court Order is entered by the United States District Court for the District of Alaska or a notification is filed with the United States District Court for the District of Alaska and any terms and conditions placed on the funding by the Trustee Council have been met.

7. *Federal Account.* In accordance with federal law, funds required for federal project implementation are deposited in the Natural Resource Damage Assessment and Restoration (NRDA&R) Fund managed by the Department of the Interior.

8. *State Account.* In accordance with state law, funds required for state project implementation are deposited in the *Exxon Valdez* Oil Spill Settlement Fund.

INVESTMENT FUND

1. *General.* Under Public Law 106-113 (1999), some or all of the joint trust funds may be deposited in the Natural Resource Damage Assessment and Restoration Fund or accounts outside the United States Treasury, or both. Where the Trustee Council exercises this authority, it is responsible for the prudent investment of the settlement funds in income-producing obligations and other instruments or securities that have been determined by unanimous vote of the Trustee Council to have a high degree of reliability and security.

2. *Policies.* The Trustee Council shall adopt written investment policies to protect and manage an Investment Fund(s).

3. *Asset Allocation.* The Trustee Council recognizes that strategic asset allocation is the single most important policy decision affecting investment return and risk for an Investment Fund. At least annually, the Trustee Council shall evaluate its strategic asset allocation.

4. *Reporting.* Revenues and disbursements associated with the Investment Fund shall be reported to the Trustee Council on a monthly basis. Fees assessed by the Alaska Department of Revenue for the Investment Fund shall be paid on a quarterly basis.

PROJECT AUTHORIZATION

1. *General.* Authorization to expend personal services, travel, contractual, commodities, equipment and general administration funds shall be consistent with the project budgets approved by the Trustee Council.

2. *Fiscal Year.* Unless otherwise approved by the Trustee Council, the fiscal year begins on October 1 and ends on September 30. In the event the Trustee Council approves a project with a

different fiscal year, the fiscal year must be clearly stated in the approval motion. In the event the Trustee Council approves a capital project, the designation as a capital project must be clearly stated in the approval motion.

3. *Adjustments.* As long as an adjustment does not alter the underlying scope or objectives of the affected projects, agencies have the authority to move funds into or out of projects up to the cumulative amount of $10,000 or up to 10% of the authorized level of funding for each affected project, whichever is less. In addition, as long as an adjustment does not alter the underlying scope or objectives of the project, agencies are authorized to move, within a single project, budgeted funds between line items and may change detailed items of expenditure to accommodate circumstances encountered during budget implementation. Justification and supporting documentation as to the reason for all such adjustments (both between projects and line-items) shall be maintained by the agencies. All adjustments between projects shall be reported to the Executive Director in the Quarterly Financial Report. For further information regarding the Quarterly Report, refer to the Accounting section of these procedures.

4. *Revisions.* Trustee Council action is required to move amounts greater than that authorized in section 3 above. Trustee Council action is also required if the revision changes the scope or objectives of a project, establishes a new project, or terminates an approved project during the fiscal year. In the event the proposed revision changes the scope or objectives of a project, establishes a new project, or terminates an approved project during the fiscal year, the public shall be given a reasonable opportunity to review and comment on the proposed change prior to action of the Trustee Council.

PROJECT COSTS

1. *Direct Project Costs.* Direct costs are those costs that can be identified with or linked to a specific project.

2. *Indirect Project Costs.* Indirect costs are those costs that are incurred for common or joint projects and therefore cannot be identified readily and specifically with a specific project. In the case of governmental agencies, indirect costs are covered through a general administration formula. The appropriate indirect rate for contractors shall be approved on a case-by-case basis.

3. *General Administration Formula.* The general administration formula is used to reimburse governmental agencies for indirect project costs incurred in implementing the restoration program. The general administration formula is nine percent of each project's direct costs. General administration funds may be spent at the agency's discretion provided they are spent on indirect costs incurred in implementing activities funded by the Trustee Council. Agencies are entitled to 100% of their budgeted general administration funds regardless of how much of their budgeted direct project funds have been expended.

4. *Unallowable Costs.* Restoration funds shall be used only for costs that directly benefit Trustee Council approved projects with the exception of reimbursement of general administration (i.e., indirect) costs that are calculated in accordance with the general administration formula.

5. *Bonuses.* Bonuses for personnel working on Trustee Council funded activities are allowable costs. Agencies shall follow their standard operating procedures in determining bonus awards. Bonuses shall be considered an indirect project cost and, if awarded, shall be paid with General Administration funds.

ACCOUNTING

1. *General.* It is the responsibility of agency personnel and certifying officers to make certain that all actions are based on sound accounting and budgetary practices.

2. *Source Documentation.* Adequate justification and supporting documentation shall be maintained for each project.

3. *Appropriateness.* Expenditures charged to a project shall be directly attributable to or allocated to the project benefiting from the activity. Salaries and benefits may be charged for the time an individual is working directly on a project, when supported by time sheets and when work performed by such individuals is necessary to the project.

4. *Reasonableness.* Costs attributable to a project shall be necessary and reasonable to achieve the objectives of the project and be consistent with the policies and procedures governing other activities of the agency.

5. *Segregation.* Accounts shall be properly designed and maintained to ensure that funds are expended in accordance with Trustee Council approval.

6. *Expended (Outlays).* The term expended shall be defined as the actual outlay of funds through the issuance of checks or warrants, the disbursement of cash, or the electronic transfer of funds. The term expenditure shall be defined as the act of expending.

7. *Obligations (Encumbrances).* The term obligations shall be defined as a commitment to acquire goods or services during the fiscal year, or to accommodate contracts where the length of time for completion of the service extends into the following fiscal year. An obligation is a commitment to pay and should not be considered an expenditure until the goods or services have been received and the invoice paid. Funds approved for contracts in which the length of time for completion of the service extends into the following fiscal year may be obligated at year end. To be valid, the length of time to complete the service should be identified in the proposal approved by the Trustee Council. As a general rule, agencies shall have one year from the end of a project's approved fiscal year to satisfy all obligations.

8. *Reporting: Quarterly Financial Reports.* Within thirty days following the end of each quarter, agencies shall report expenditures and obligations recorded at the end of the quarter to the Executive Director. The report shall include the total amount authorized for each project, any revisions approved by the Trustee Council, any adjustments between projects, the total expended by project, and the total of any outstanding obligations by project.

9. *Reporting: Annual Financial Reports.* By January 31 of each year, agencies shall report to the Executive Director the total expended for each project, plus any valid obligations relating to the fiscal year just ended. The report shall reflect the total amount authorized by line-item, any revisions approved by the Trustee Council, any adjustments between projects, and any adjustments between line-items.

LAPSE

1. *General.* The unexpended and unobligated balance of a project shall lapse on September 30 of the fiscal year for which the project was approved. However, an undisclosed obligation may be established and/or paid during the Close-Out Period.

2. *Capital.* The unexpended balance of a capital project shall be carried forward for two subsequent fiscal years. At the end of the three year period, the unexpended and unobligated balance shall lapse. Trustee Council action is required to extend the project lapse date beyond the three year period.

3. *Close-Out Period.* During the months of October, November and December agencies may pay from prior year funds an expense that was undisclosed during the fiscal year just ended. In addition, agencies may establish obligations to accommodate an expense that was undisclosed during the fiscal year just ended. By January 31 of each year, agencies shall report to the Executive Director the total expended for each project, plus any valid obligations relating to the fiscal year just ended. For further information regarding the Annual Financial Report, refer to the Accounting section of these procedures.

4. *Reimbursement for Prior Year Expenses.* Expenses discovered after the Close-Out Period (i.e., after December 31) may be charged to the subsequent year's project budget if the project has multiple years of funding and sufficient funds are available. In the event the agency determines that insufficient funds are available to charge the expense to the subsequent year's budget, or the expense relates to a completed project (i.e., there is no subsequent year's budget), authority to adjust a prior year Annual Financial Report is required. During the months of January through June, authority to adjust a prior year Annual Financial Report may be provided by the Executive Director. For expenses discovered after June, authority to adjust a prior year Annual Financial Report may be provided by the Trustee Council.

EQUIPMENT

1. *Definition.* Equipment shall be defined as non-expendable items having an estimated life of more than one year and a unit value greater than $1,000.

2. *Title and Use.* Equipment shall be used for the project for which it was acquired.

(a) Items with an original per unit cost of under $5,000 shall belong to the acquiring agency. At the end of a project, if the equipment was purchased by a contractor, the agency may, at its discretion and if agency regulations allow, transfer the title to the contractor.

(b) Items with an original per unit cost of $5,000 and over shall belong to the acquiring agency on behalf of the Trustee Council. At the end of a project that has equipment with an original per unit cost of $5,000 or more, the Executive Director shall determine if the equipment item shall be used for another Trustee Council project or if the item shall remain with the acquiring agency. If the equipment shall be used for another Trustee Council project administered by an agency other than the acquiring agency, the title for the equipment shall be transferred to the agency administering the new project. If the equipment shall remain with the acquiring agency, and it was purchased by a contractor, the agency may, at its discretion and if agency regulations allow, transfer the title to the contractor.

This section shall apply to all equipment purchased under the restoration program, for projects already in progress or completed as well as for projects funded in the future.

3. *Surplus.* Equipment that belongs to the acquiring agency shall be surplused in accordance with agency procedures.

4. *Inventory.* Property records shall be maintained in accordance with agency procedures.

5. *Repair, Maintenance and Safeguarding.* The repair, maintenance and safeguarding of equipment purchased with joint funds shall be accomplished in accordance with agency procedures.

6. *Disposal.* Equipment that ceases to function shall be disposed of in accordance with agency procedures.

7. *Reporting.* By December 31 of each year, agencies shall report all equipment with an original per unit cost of $5,000 or more to the Executive Director. The report shall include a description of the equipment (make and model), date the equipment was purchased, the purchase price, where the equipment is located and the condition of the equipment. The report shall also identify the project that is using the equipment.

CONTRACTS

1. *General.* Agencies shall ensure that contracts for professional and non-professional services are accomplished in accordance with the terms, conditions, and specifications of the project approved by the Trustee Council and in accordance with applicable Federal and State laws.

2. *Definitions.* Professional services means contracts for professional, technical, or consultant services that result in the production of a report or the completion of a task, and includes analysis, evaluation, prediction, planning, or developing a recommendation. Non-professional services means contracts for services that are primarily manual in nature, and includes boat charters, printing, and other. Non-professional services contracts usually provide a service rather than resulting in a product or report.

3. *Named Recipient.* In the event the Trustee Council determines that, in order to carry out its mandate under the Memorandum of Agreement and Consent Decree, a particular person or entity should implement all or a portion of a project through a state Trustee agency, the Trustee Council may, by unanimous vote, name a contract recipient. The approval motion shall include the reason for selecting the contract recipient. If the contracting agency determines that an award to an entity different than that named by the Trustee Council would better serve the program, the basis of that determination shall be stated in writing to the Executive Director and forwarded to the Trustee Council for approval.

4. *Indirect Rates.* The appropriate indirect rate for contractors shall be determined on a project by project basis or through a memorandum of understanding with a contractor that provides for a consistent rate and methodology.

5. *Equipment.* Equipment purchased by the contractor shall remain the property of the contracting agency unless other conditions prevail. See section on Equipment, Title and Use, for specific details.

6. *Special Considerations.* All notes and other data developed by the contractor shall remain the sole property of the contracting agency.

GRANTS

1. *General.* Grants may be used as a procurement mechanism, but only to the extent they are permitted under existing state and federal laws. Federal Trustee agencies were given grant authority specific to the Trustee Council's program under Public Law 106-113 (1999).

AUDITS

1. *General.* The purpose of an audit is to ensure public trust and accountability regarding the use of settlement funds. An audit provides credibility to the information reported by or obtained from management by independently acquiring and evaluating the evidence.

2. *Definition.* The term audit includes both financial and performance audits.

3. *Readiness.* When an agency receives funding from the Trustee Council, the agency assumes certain responsibilities with respect to those funds. These include ensuring that source documentation is organized and available for review, internal controls are documented and individuals knowledgeable about the projects are available to answer questions.

4. *Contracts.* Contractors who receive funding for professional or non-professional services are not automatically subject to an annual audit. However, this does not preclude the Trustee Council or the agency from making a determination that an audit is required in addition to an agency's review of expenditure documentation and work produced by a contractor.

5. *State and Federal Audits.* Each Federal agency and the State of Alaska have audit functions. In the event an audit is performed on a Trustee Council funded activity, a copy of the audit shall be provided to the Executive Director.

6. *External Audits.* All external audits shall be conducted in accordance with Governmental Auditing Standards. In addition, the firm and the staff assigned to conduct the audit shall be independent of the Trustee Council, the funding agencies, the Alaska Department of Revenue, the Court Registry Investment System, Exxon Corporation, Exxon Shipping Company and Exxon Pipeline Company.

APPENDIX A: FEDERAL INTERNAL PROCEDURES

NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION FUND

1. *Segregation.* All principal and interest shall be accounted for separately by the Department of the Interior, Office of the Secretary. Each disbursement shall be assigned an appropriate account, sub-activity and/or project number when deposited to the aggregate Natural Resource Damage Assessment and Restoration Fund within the Federal Reserve Bank. Confirmation of the deposit shall be provided to the Treasury Department, which reconciles the deposit with the Federal Reserve Bank.

2. *Investments.* By law, the funds may only be invested in Treasury Securities and all ownership is maintained in the name of the Natural Resource Damage Assessment and Restoration Fund. Based on an estimate of cash flow requirements, the Department of the Interior, Office of the Secretary generates instructions for investment and forwards the instructions to the National Business Center. The National Business Center develops and submits an Investment Confirmation Letter that indicates which account investments are being purchased, the scheduled maturity dates and the investment type(s) to the Department of Treasury, which purchases the securities. At maturity, interest income is paid directly to the account.

3. *Reports.* Quarterly, the Department of the Interior shall report interest income to the Executive Director. In addition, all disbursements to the federal agencies shall be reported to the Executive Director. By March 31 of each year, the Department of Interior shall report to the Executive Director all lapsed funds returned to the Natural Resource Damage Assessment and Restoration Fund by the federal agencies.

AUTHORIZATION

1. *General.* Congress permanently appropriated funding approved by the Trustee Council in Section 207 of Public Law 102-227. However, all authorization is subject to compliance with any terms and conditions imposed by the Trustee Council.

2. *Budget and Reports.* Under Section 207, agencies are required to comply with directions published by the Federal Office of Management and Budget. This includes submitting a budget for the upcoming fiscal year and documentation associated with the current and prior fiscal year.

3. *Obligation Authority.* Prior to the obligation of any funds, agencies must first complete the allocation process required by their respective budget offices to establish codes for each project. The allocation process provides the authority, amount of funding and the guidance with which to obligate funds.

4. *Instructions for Transfer.* Federal agencies are required to submit an annual cash flow plan to the United States Department of the Interior, Office of the Secretary, Natural Resource Damage Assessment and Restoration Office, and instructions regarding the transfer of settlement funds. The instructions shall specify the purpose of the transfer, which account the funds are to be transferred to, and an estimate of cash flow requirements. Unless the transfer represents a one-time payment, the cash flow estimate shall be structured on a quarterly basis. Any change in cash flow requirements that occurs during the fiscal year shall be communicated to the United States Department of the Interior, Office of the Secretary, Natural Resource Damage Assessment and Restoration Office, in writing. A change is defined as a decrease in the cash flow requirement due to an unanticipated delay in a project or an increase in the cash flow requirement due to an unanticipated change in the schedule, or subsequent Trustee Council action.

5. *Fund Transfers.* The vehicle used for transfers is a SF1151, a non-expenditure transfer. The SF1151 is initiated, prepared, and approved by the Natural Resource Damage Assessment & Restoration Office, Office of the Secretary and then sent to Treasury where the funds are transferred within the Treasury system.

6. *Return of Unobligated Balances.* On March 15 of each year, federal agencies shall return to the Natural Resource Damage Assessment and Restoration Fund the unobligated balance for the fiscal year just ended. Concurrently, the agencies shall return any recovery of prior year obligations. Agencies are required to submit to the United States Department of the Interior, Office of the Secretary, Natural Resource Damage Assessment and Restoration Office, a report reflecting the total unobligated balance for the fiscal year just ended and the amount of funding recovered from prior year obligations. The report submitted shall also indicate the date the agency intends to return the funds. The vehicle used for transfers is a SF1151, non-expenditure transfer. The Department of the Interior shall report the total unobligated balance for the fiscal year just ended and the amount of funding recovered from prior year obligations to the Executive Director by March 31 of each year.

APPENDIX B: STATE INTERNAL PROCEDURES

EXXON VALDEZ OIL SPILL SETTLEMENT FUND

1. *Segregation.* All principal and interest shall be accounted for separately by the Alaska Department of Revenue, Division of Treasury. Each disbursement shall be deposited in a Department of Law sub-account, *Exxon Valdez* Oil Spill Settlement Fund. Confirmation of the deposit shall be provided by the bank to the Alaska Department of Revenue.

2. *Investments.* The Alaska Department of Revenue, Division of Treasury shall calculate the daily income amount and provide for daily compounding (including weekends and holidays). The income shall be credited to the fund and posted in the Alaska State Accounting System on a monthly basis.

3. *Reports.* The Alaska Department of Revenue, Division of Treasury shall report income earned to the Executive Director on a monthly basis.

AUTHORIZATION

1. *General.* Pursuant to Alaska Statute 37.14.405(a), a state agency may not expend money received from the trust unless the expenditure is in accordance with an appropriation made by law. However, prior to the expenditure of funds, Trustee Council approval must be obtained, the notice filed, any terms and conditions placed on the funding by the Trustee Council met, and the funds transferred from the Investment Fund to the *Exxon Valdez* Oil Spill Settlement Fund, if necessary.

2. *Budget and Reports.* To meet the requirements of Alaska Statute 37.14.415, agencies are required to comply with directions published by the State Office of Management and Budget, Division of Budget Review. Alaska Statute 37.14.415 states: The state trustees shall

(a) submit to the governor and the legislature by December 15 of each year a report setting out, for each object or purpose of expenditure, the amounts approved for expenditure from the trust during the preceding fiscal year and the amounts actually expended during the preceding fiscal year;

(b) prepare and submit, under AS 37.07, a budget for the next fiscal year setting out, for each object or purpose of expenditure, the Trustees' estimate of the amounts that are, during the next fiscal year, to be funded by the trust and expended by state agencies; and

(c) prepare and submit to the legislature, at the same time the budget for state agency expenditures is submitted under (b) of this section, a proposal setting out, for each object or purpose of expenditure, the trustees' estimate of the amounts that are to be funded by the trust in the next fiscal year and that are not included in the budget submitted under (2) of this section.

3. *Legislative Budget and Audit Committee.* Alaska Statute 37.14.405(b) allows agencies to meet the requirements of an appropriation conditioned on compliance with the program review

provisions of AS 37.07.080(h). In accordance with the procedures of the Alaska Office of Management and Budget (OMB), agencies are required to submit a request to OMB for transmittal to the Legislative Budget and Audit Committee.

4. *Expenditure Authority.* Authorization to receive and expend shall be recorded in the Alaska State Accounting System within the *Exxon Valdez* Oil Spill Settlement Fund. Following legislative action, OMB will record the authorization by approving an Authorized Budget Transaction (AB).

APPENDIX C: INVESTMENT FUND(S)

1. *General.* The Trustee Council, through appropriate state and/or federal agencies, may contract for investment, custodial or depository services on a discretionary or non-discretionary basis, with the State and Federal governments, or with independent investment management firms, banks, financial institutions or trust companies by designation through appointments, contracts or letters of authority.

2. *Segregation.* All principal and interest shall be accounted for separately by the custodian.

3. *Reports.* The custodian shall provide to the Executive Director financial reports on a monthly basis. The monthly report shall reflect all activity associated with the Investment Fund(s) including the date and amount of each transaction, any pending transactions, interest received, purchases, sales and other transactional data on a day-to-day basis. In addition, the custodian shall provide a monthly report which sets forth the opening balance in the Investment Fund(s), associated transactions and a reconciliation to the final balance. The investment manager shall provide to the Executive Director a suite of financial and performance reports on a monthly basis. The monthly financial report shall contain an asset appraisal which sets forth all of the assets held by the Investment Fund(s). The report shall provide detailed information such as cost and market value, current yield and percentage of each investment and sector. In addition, the investment manager shall provide monthly and cumulative performance reports. The performance reports shall include a comparison to the benchmarks approved by the Trustee Council.

4. *Investments.* By unanimous consent, the Trustee Council shall determine the strategic asset allocation and bands. The Executive Director shall have discretion to move assets among asset categories provided that such actions are consistent with movement of the actual asset allocation within the variability bands of the Trustee Council's strategic asset allocation policy. The Executive Director shall make the necessary adjustments to the initial target allocation within 30 calendar days. The Executive Director shall report any asset shifts at the next Trustee Council meeting. Such reports shall include a description of the rationale for the shift.

5. *Performance.* The Trustee Council shall identify benchmarks to evaluate Investment Fund(s) performance. Performance shall be evaluated relative to the identified benchmarks and also relative to an appropriate peer group of competitive alternatives. On a biannual basis, performance shall be presented to the Trustee Council.

6. *Fees.* No fees shall be assessed by the custodian except as approved in advance by the Trustee Council.

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
PROCEDURES FOR THE PREPARATION & DISTRIBUTION OF REPORTS
Updated July 2002

INTRODUCTION

These *Procedures for the Preparation and Distribution of Reports* provide instructions regarding the preparation, peer review, printing and distribution of final and annual reports for projects funded by the *Exxon Valdez* Oil Spill Trustee Council.

Unless otherwise specified by the Trustee Council Office, each project funded by the Trustee Council shall ultimately produce a final report subject to approval through the Trustee Council's peer review process. In the case of multi-year projects, an annual report shall also be prepared each year until the project is completed, at which time a final report shall be prepared. Subject to the approval of the Trustee Council Office, on a project-by-project basis, journal articles or manuscripts may be used to fulfill requirements for the preparation of final reports (see below, page X).

These *Procedures for the Preparation and Distribution of Reports* update and supersede earlier versions of this document and should be read together with the report writing guidelines published by the *Journal of Wildlife Management* (Ratti, J. and L. Smith, 1998). (Appendix 1) To the extent that there are any inconsistencies between these *Procedures for the Preparation and Distribution of Reports* and the guidance provided by Ratti, J. and L. Smith (1998), the instructions provided in these *Procedures* shall be followed.

The primary changes in these *Procedures*, as compared to the previous version of this document (October 1998), are a new format and review process for annual reports (see page XX) and the addition of review procedures for Gulf Ecosystem Monitoring and Research (GEM) project final reports (see page XX).

NOTE: For purposes of identification, GEM projects each have a six-digit project number preceded by the letter G (e.g., G-030204, G-042362). The letter G signifies GEM; the first two digits identify the fiscal year in which the project was authorized; and the last four digits provide a specific project identifier. Restoration projects each have a five or six-digit project number (e.g., 95225, 034520--those funded before FY 03 have five digits; those funded for FY 03 and after have six digits). The first two digits identify the fiscal year in which the project was authorized; the last three or four digits provide a specific project identifier. Natural Resource Damage Assessment (NRDA) projects are designated by alpha-numeric project numbers (e.g., MM6 for "Marine Mammal Study 6" or FS2 for "Fish/Shellfish Study 2").

Purpose. A final report for a project must be a comprehensive report addressing all the objectives identified over the course of the entire study. The final report shall address the original objectives of the study as identified in the approved proposal and account for any changes in the objectives. Final NRDA reports shall be viewed as both the first and last word on the subject for the purpose of damage assessment under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and its amendments. The principal investigator for a project is responsible for the submission and production of a final report.

I. Preparation: NRDA, Restoration & GEM Project Final Reports

1. **Final Report Format** - Authors shall follow the format set out below to prepare final reports. Reports shall meet normal scientific standards of completeness and detail that shall permit an independent scientific reader to evaluate the reliability and validity of the methods, data and analyses.

   A. **Report Cover** – An example of a final report cover is provided. Quality cover stock shall be used and, to ensure consistent appearance, color shall be goldenrod. (Attachment A) A final report cover shall:

- identify the report as either a[1]

  ✓ Natural Resource Damage Assessment final report,
  ✓ Restoration Project final report, or
  ✓ Gulf Ecosystem Monitoring and Research Project final report;

- provide the report title;

- include the project identification number;

- identify the author(s) with appropriate affiliation(s);

- include the date (month and year) of publication; and

- include the following non-discrimination statement toward the bottom of the page on the inside front cover:

1 Include on the Report Cover and the Title Page the following uniform titles. For NRDA reports: *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report. For Restoration Project final reports: *Exxon Valdez* Oil Spill Restoration Project Final Report. For GEM Project final reports: *Exxon Valdez* Oil Spill Gulf Ecosystem Monitoring and Research Project Final Report. See Attachment A.

The *Exxon Valdez* Oil Spill Trustee Council administers all programs and activities free from discrimination based on race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The Council administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972. If you believe you have been discriminated against in any program, activity, or facility, or if you desire further information, please write to: EVOS Trustee Council, 441 West 5th Avenue, Suite 500, Anchorage, Alaska 99501-2340; or O.E.O. U.S. Department of the Interior, Washington D.C. 20240.

B. **Title Page** - The Title Page of the report shall immediately follow the report cover page on white bond paper and be identical in terms of content and format to the front of the report cover page. (Attachment A)

C. **Study History, Abstract, Key Words, Project Data and Citation** - Following the Title Page, the report shall include, on not more than two pages: (1) a study history; (2) an abstract; (3) key words; (4) summary of data gathered during the project; and (5) a recommended citation for the final report. (Attachment A)

- **Study History**. A brief study history shall include reference to any prior project numbers; changes in the title of the project or report over time; annual reports or other reports which contributed to the final report; and citation of publications that have preceded publication of the final report.

- **Abstract**. An abstract, with a maximum length of 200 words,[2] shall enable readers to quickly identify the basic content of the report, determine its relevance to their interests and thus decide whether to read the document in its entirety. If the final report consists of several chapters or manuscripts (see Use of Manuscripts for Report Writing below, page X), the abstract shall summarize the entire report. Do not use abbreviations or acronyms in the abstract.

- **Key Words**. A short list of key words (up to 12 in alphabetical order) shall be provided. Include words from the title and others that identify: (1) common and scientific names of principal organisms, if any; (2) geographic area or region; (3) phenomena and entities studied (e.g., behavior, reproduction, etc.); (4) methods (only if the report describes a

2 A limit of 200 words is needed so that the abstract can be processed through the National Technical Information Service.

new or improved method); and (5) other words not covered above but useful for indexing.

- **Project Data**. A summary of the data collected during the project shall be provided in order to preserve the opportunity for other researchers and the public to access this data in the future. The summary shall: (1) *describe* the data; (2) indicate the *format* of the available data collections; (3) identify the *archive* in which the data have been stored or the *custodian* of the data (including contact name, organization, address, phone/fax, e-mail, and web address where data may be acquired); and (4) indicate any access limitations placed on the data. Limiting access requires pre-approval by the Trustee Council Office.

- **Citation**. A recommended citation for the final report shall be provided.

D. **Remainder of Report** - After the Study History, Abstract, Key Words, Project Data and Citation, the report shall continue as follows:

- **Table of Contents, including Lists of Tables, Figures and Appendices.**

- **Executive Summary**. The executive summary shall:

  ✓ consolidate principal points of the report in one place and provide enough detail for the reader to digest the significance of the report without having to read it in full;

  ✓ be written so that it can stand independently of the report (i.e., it must not refer to figures, tables or references contained elsewhere and all acronyms, uncommon symbols, and abbreviations must be spelled out);

  ✓ not exceed four single-spaced pages;

  ✓ concisely state the objectives, methods, results and conclusions of the report; and

  ✓ be organized in the same manner as the report it summarizes.

- **Introduction**. The introduction shall:

  ✓ present first, with all possible clarity, the nature and scope of the problem investigated, including the general area in which field activities were conducted; and

- ✓ review pertinent literature, state the method(s) of investigation and briefly state principal results.

- **Objectives**. The statement of objectives shall be the same as the objectives identified in the approved proposal. If the objectives have changed, describe what has changed and why.

- **Methods**. The discussion of methods shall include a clear description of the study area. To the extent the methodology differs from that described in the proposal, explain the reason for the deviation.

- **Results**. The presentation of results shall:

  - ✓ provide an objective and clear presentation of the data collected; and

  - ✓ in the case of damage assessment studies, present information in a manner that will make clear to the reader: (1) evidence of injury found, and (2) evidence that the injury found was or was not caused by the *Exxon Valdez* oil spill.

- **Discussion**. The discussion section shall:

  - ✓ interpret the study results and explore the meaning and significance of the findings, including alternative interpretations of the results;

  - ✓ discuss whether the study hypotheses were upheld or disproven;

  - ✓ note where there are unanswered questions; and

  - ✓ where appropriate, cite relevant findings from other *Exxon Valdez* oil spill restoration studies, including GEM studies, and published literature.

- **Conclusions**. This shall be a brief, clear statement of the conclusions that are apparent from the discussion. Major unanswered questions shall be identified.

- **Acknowledgments**.

- **Literature Cited**.

- **Other References**. If there is a need to list references other than the literature cited (for example, personal communications), these references shall be identified in this section.

2. **Technical Format** - The following guidelines shall help provide consistent formatting:

A. **Word Processing Conventions**

- **Standard Settings.**

Line	
Line spacing:	single
Hyphenation:	off (i.e., do not hyphenate at right margin)
Justification:	left (i.e., do not right-justify margins)
Margins:	1 inch at top, bottom 1 inch left, right
Tabs:	every 0.5"
Widow Protection:	yes
Page	
Page numbering:	bottom center
Header:	none
Font	
Times:	12 point

Note: If Times is not available, some other serif font shall be used (e.g., Palatino, Bookman or New Century Schoolbook).

- **Literature Citations.** In the Literature Cited section, start each citation with a hanging indent as shown below:

Byrd, G.V., D. Gibson, and D.L. Johnson. 1974. The birds of Adak Island, Alaska. Condor 76:288-300.

B. **Other Conventions**

- Use italics, rather than underlining, for Latin names and for *Exxon Valdez*.

- Use good quality white paper 8.5 x 11" (215 x 280mm) or metric size A4.

- Do not use dot matrix printers to print the report.

- When referring to the oil spill that occurred because the *Exxon Valdez* ran aground, use *Exxon Valdez* oil spill. After the first mention of the *Exxon Valdez* oil spill, refer to it simply as the spill.

- Clearly define any acronyms. Avoid the use of acronyms completely in the Abstract and Executive Summary.

- Use the terms "damages" and "injury" as defined by CERCLA regulations (see 43 CFR 11.14):

  "Damages" means the amount of money sought by the natural resource trustee as compensation for injury, destruction or loss of natural resources.

  "Injury" means a measurable adverse change, either long or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil. Injury encompasses the phrases "destruction" and "loss."

    "Destruction" means the total and irreversible loss of a natural resource.

    "Loss" means a measurable adverse reduction of a chemical or physical quality or viability of a natural resource.

3. **Use of Manuscripts for Final Report Writing** - The Trustee Council expects principal investigators to publish the results of their work in peer-reviewed journals. Manuscripts or journal articles may be used to help satisfy project final report writing requirements. Principal investigators shall contact the Science Director at the Trustee Council Office to request authority to use a manuscript(s) as the body of a final report.

   Because final reports are the primary and permanent record of how Trustee Council funds have been spent and what has been accomplished with those funds, it is necessary that these reports address all of the objectives for which the Trustee Council has provided funds. If all of the project's objectives are completely described within one or more manuscripts being prepared for publication, then a copy of the manuscript(s) may be submitted as the entire body of the report. If a project's objectives are not all described completely within one or more manuscripts, the manuscript(s) may serve as a portion of the report.

   For example, if only two of five project objectives are addressed in a manuscript, the report shall include—in addition to the manuscript—information on the three objectives not covered in the manuscript. The two objectives covered by the manuscript shall be referenced in the report as appropriate (e.g., in the Methods and Results sections) and substantially integrated into the Discussion section, where there shall be an overall discussion of the project. In such cases, the combination of the manuscript and additional report material shall present an organized, integrated and complete account of project activities and results.

In addition, every report, regardless of whether it is in the standard format or includes manuscripts, shall adhere to the formatting prescribed for the Report Cover, Title Page, Study History, Abstract, Key Words, Project Data and Citation (see above, Final Report Format, page XX).

Please note that when a manuscript is used to fulfill report writing requirements, it must be in a form that can be duplicated freely. This may require obtaining a release of copyright restrictions.

Investigators seeking to publish the results of Trustee Council sponsored projects shall include the following statement with all manuscripts:

> The research described in this paper was supported by the *Exxon Valdez* Oil Spill Trustee Council. However, the findings and conclusions presented by the author(s) are their own and do not necessarily reflect the views or position of the Trustee Council.

Investigators who publish the results of Trustee Council sponsored projects shall provide the Trustee Council Office (attn: Science Director) 3 reprints of any published manuscript. The Trustee Council Office shall provide 1 of the reprints to Alaska Resources Library and Information Services (ARLIS).

4. **Due Date** - Final reports shall be *submitted for peer review by April 15 of the year following the fiscal year in which project work was completed* unless a different date is specified in the approved proposal or contract. If this due date cannot be met, the principal investigator shall notify the Trustee Council Office in writing. With the approval of the Executive Director, an alternative final report due date may be identified.

II. Review Process: NRDA & Restoration Final Reports

See III below for review process for GEM final reports.

1. **Submission of Draft Final Report for Peer Review** - The principal investigator shall submit 4 paper copies and 1 electronic copy of the draft final report for peer review, as follows:

   - ✔ 3 paper copies and 1 electronic copy of the draft final report to the chairman of the Trustee Council's Lingering Oil Effects Subcommittee. The electronic copy shall be submitted as a word processing document (Microsoft Word 2000 for Windows or lower or WordPerfect 9.0 or lower) with any figures and tables imbedded; and
   - ✓ 1 paper copy of the draft final report to the Trustee Council's Science Director.

(addresses next page)

Dr. Robert Spies Chair, Lingering Oil Subcommittee 4749 Bennett Drive, Suite L Livermore, California 94550	phone: (925) 373-7142 fax: (925) 373-7834 spies@amarine.com
Science Director Trustee Council Office 441 W. 5th Ave., Suite 500 Anchorage, Alaska 99501	phone: (907) 278-8012 fax: (907) 276-7178 phil_mundy@oilspill.state.ak.us

2. **Final Report Peer Review and Acceptance Process** - Under the guidance of the chairman of the Lingering Oil Effects Subcommittee, draft final reports are peer reviewed by one or more qualified reviewers who provide comments, identify questions and suggest revisions as appropriate.

    - Peer review comments shall be provided in writing by the chairman of the Lingering Oil Effects Subcommittee to the principal investigator(s).

    - Final reports shall be revised by the principal investigator to address peer review comments and resubmitted for final acceptance, as above (3 paper copies and 1 electronic copy of the revised final report to the chairman of the Lingering Oil Effects Subcommittee and 1 paper copy of the revised final report to the Science Director).

    - Once the final report is accepted, the chairman of the Lingering Oil Effects Subcommittee shall notify the principal investigator in writing and send a copy of the letter of acceptance to the Science Director.

3. **Final Report Review as to Form** - Once accepted by the chairman of the Lingering Oil Effects Subcommittee, the principal investigator shall prepare the final report for publication.

    - Within 30 days of the date on which the chairman of the Lingering Oil Effects Subcommittee accepts the final report, the principal investigator shall submit the first several pages of the approved final report to ARLIS for format review (i.e., Cover, Title Page, Study History, Abstract, Key Words, Project Data and Citation). These pages can be mailed, faxed, or e-mailed to ARLIS (attention: Carrie Holba):

Carrie Holba ARLIS 3150 C Street, Suite 100 Anchorage, AK 99503	phone (907) 272-7547 fax (907) 271-4742 carrie@arlis.org

- Within 15 days of receipt of the first several pages of the final report, ARLIS staff shall review it for compliance with the report format standards and notify the principal investigator in writing regarding any changes that need to be made.

- To be certain that format revisions are made correctly, the principal investigator shall fax a copy of the corrected version to ARLIS. The principal investigator shall not reproduce the report until format approval is confirmed in writing by ARLIS.

III. Review Process: GEM Final Reports

See II above for review process for NRDA and Restoration final reports.

1. **Submission of Draft Final Report for Peer Review** - The principal investigator shall submit 3 paper copies and 1 electronic copy of the draft final report to the Science Director for peer review. The electronic copy shall be submitted as a word processing document (Microsoft Word 2000 for Windows or lower or WordPerfect 9.0 or lower) with any figures and tables imbedded. (See address page XX.)

2. **Final Report Peer Review and Acceptance Process** - Under the guidance of the Science Director, draft final reports are peer reviewed by one or more qualified reviewers who provide comments, identify questions and suggest revisions as appropriate.

    - Peer review comments shall be provided in writing by the Science Director to the principal investigator(s).

    - Final reports shall be revised by the principal investigator to address peer review comments and resubmitted for final acceptance, as above (3 paper copies and 1 electronic copy to the Science Director).

    - Once the final report is accepted, the Science Director shall notify the principal investigator in writing.

3. **Final Report Review as to Form** - Once accepted by the Science Director, the principal investigator shall prepare the final report for publication.

    - Within 30 days of the date on which the Science Director accepts the final report, the principal investigator shall submit the first several pages of the approved final report to ARLIS for format review (i.e., Cover, Title Page, Study History, Abstract, Key Words, Project Data and Citation). These pages can be mailed, faxed, or e-mailed to ARLIS (attention: Carrie Holba; see address page XX).

    - Within 15 days of receipt of the first several pages of the final report, ARLIS staff shall review it for compliance with the report format

standards and notify the principal investigator in writing regarding any changes that need to be made.

- To be certain that format revisions are made correctly, the principal investigator shall fax a copy of the corrected version to ARLIS. The principal investigator shall not reproduce the report until format approval is confirmed in writing by ARLIS.

IV. Printing and Distribution Process: NRDA, Restoration & GEM Project Final Reports

1. **Reproduction and Number of Copies** - Within 60 days of the date of the written confirmation from ARLIS indicating approval of the final report format, the principal investigator shall remove all references to "draft" from the report and produce final copies as follows:

    - **Two-sided Pages.** The body of the report shall be printed in two-sided format to reduce the space needed to store reports.

    - **Number of Copies: NRDA & Restoration Project Reports.** The principal investigator shall provide a total of 21 paper copies and 1 electronic copy, as follows:

        ✓ 1 bound copy of the approved final report to the chairman of the Lingering Oil Effects Subcommittee;
        ✓ 18 bound copies and 2 camera ready copies of the approved final report to ARLIS, which shall include a copy for the Science Director and a copy for the Trustee Council's official record. A camera-ready copy is an unbound copy of the report as it will appear in its final format, except that it is single-sided with blank pages inserted as appropriate; and
        ✓ 1 electronic copy to the Science Director. The electronic copy may be submitted either as an Acrobat Portable Document Format (PDF) file or word processing document (Microsoft Word 2000 for Windows or lower or WordPerfect 9.0 or lower) with all figures and tables imbedded. Acrobat PDF 4.0 or above file format shall be used, preferable in 'formatted text with graphics' (called "PDF normal" under Acrobat PDF 4.0) format. Minimally, "PDF searchable image" (called "PDF original image with hidden text" under Acrobat PDF 4.0) may be used if pre-approved by the Trustee Council Office. In either case, the PDF file shall not be secured or locked from future editing, or contain a digital signature from the principal investigator.

- **Number of Copies: GEM Project Reports.** The principal investigator shall provide a total of 21 paper copies and 1 electronic copy, as follows:

  ✓ 1 bound copy of the approved final report to the chairman of the Lingering Oil Effects Subcommittee;
  ✓ 18 bound copies and 2 camera ready copies of the approved final report to ARLIS, which shall include a copy for the Science Director and a copy for the Trustee Council's official record. A camera-ready copy is an unbound copy of the report as it will appear in its final format, except that it is single-sided with blank pages inserted as appropriate; and
  ✓ 1 electronic copy to the Science Director. The electronic copy may be submitted either as an Acrobat Portable Document Format (PDF) file or word processing document (Microsoft Word 2000 for Windows or lower or WordPerfect 9.0 or lower) with all figures and tables imbedded. Acrobat PDF 4.0 or above file format shall be used, preferable in 'formatted text with graphics' (called "PDF normal" under Acrobat PDF 4.0) format. Minimally, "PDF searchable image" (called "PDF original image with hidden text" under Acrobat PDF 4.0) may be used if pre-approved by the Trustee Council Office. In either case, the PDF file shall not be secured or locked from future editing, or contain a digital signature from the principal investigator.

2. **Binding** - Copies of final reports shall be bound using PERFECT binding. Smaller reports may be bound with black tape or comb binding. Very small reports may be bound with staples in three places along the spine, but only when other binding options are not available. Questions regarding binding shall be directed to ARLIS (attention: Carrie Holba; see address page XX).

3. **Distribution of Final Reports** - ARLIS shall distribute the bound and camera-ready copies of final reports to the appropriate individuals and libraries. (Attachment C) Final reports shall be posted on the Trustee Council website at www.oilspill.state.ak.us

ANNUAL REPORTS: RESTORATION & GEM PROJECTS

NOTE: This section was substantially revised on July 9, 2002 and applies to all annual reports due after that date.

Purpose. In the case of multi-year projects, an annual report shall be prepared each year until the project is completed, at which time a final report shall be prepared. All NRDA annual reports have been completed, and so are not addressed in this section of the *Procedures*. The principal investigator for a project is responsible for the submission and production of an annual report.

I. Preparation of Annual Reports

1. **Annual Report Format** – Annual reports shall be brief documents (2-3 pages) that include the information listed below. An example of the annual report form, available for downloading from the Trustee Council's web site (www.oilspill.state.ak.us) or from the Trustee Council Office upon request, is provided. (Attachment B)

   - **Project Number**
   - **Project Title**
   - **Investigator's Name(s)**
   - **Time Period Covered by the Report**
   - **Date of Report**
   - **Summary of Work Performed** – This section shall include a brief summary of work performed during the reporting period, including any results available to date and their relationship to the original project objectives. Any deviation from the original project objectives, procedures or statistical methods, study area, or schedule shall be included. Any known problems or unusual developments, and any other significant information pertinent to the project, shall also be described.
   - **Summary of Future Work to be Performed** – This brief summary shall describe work to be performed during the upcoming year, if changed from the original proposal. A description of any proposed changes in objectives, procedural or statistical methods, study area, or schedule shall be included.
   - **Coordination/Collaboration** – This section shall describe efforts undertaken during the reporting period to achieve the coordination and collaboration provisions of the proposal, if applicable.
   - **Community Involvement/TEK and Resource Management Applications** – This section shall describe efforts undertaken during the reporting period to

achieve the community involvement/TEK and resource management application provisions of the proposal, if applicable.

- **Information Transfer** – This section shall list (a) publications produced during the reporting period, (b) conference and workshop presentations and attendance during the reporting period, and (c) data and/or information products developed during the reporting period.

- **Budget** – This section shall explain any differences and/or problems between actual and budgeted expenditures, including any substantial changes in the allocation of funds among line items on the budget form. Any new information regarding matching funds or funds from non-Trustee Council sources for the project shall be included.

2. **Due Date** – Annual reports shall be *submitted by September 1 of each fiscal year for which a project receives funding*, with the exception of the final funding year in which a final report shall be prepared. The information in the annual reports shall be a key component in the Trustee Council's annual decision to continue funding a project. Failure to submit an annual report by September 1 of each year, or unsatisfactory review of an annual report, will result in withholding of additional project funds, cancellation of the project, or denial of funding for future projects.

II. Review of Annual Reports

1. **Submission of Annual Report for Review** – The principal investigator shall electronically submit the annual report to the Trustee Council's Science Director, care of katharine_miller@oilspill.state.ak.us The electronic copy shall be submitted either as an Acrobat Portable Document Format (PDF) file or word processing document (Microsoft Word 2000 for Windows or lower or WordPerfect 9.0 or lower) with any figures and tables imbedded. Acrobat PDF 4.0 or above file format shall be used, preferably in 'formatted text with graphics' (called "PDF normal" under Acrobat PDF 4.0) format. Minimally, "PDF searchable image" (called "PDF original image with hidden text" under Acrobat PDF 4.0) may be used if pre-approved by the Trustee Council Office. In either case, the PDF file shall not be secured or locked from future editing, or contain a digital signature from the principal investigator.

2. **Annual Report Review Process** – Annual reports shall be reviewed by the Science Director. Under the guidance of the Science Director, annual reports may also be reviewed by qualified outside peer reviewers. The review process shall be used to determine whether continued funding of the project is warranted and to guide further work on the project. Any written comments on annual reports shall be provided to the principal investigator and kept on file at the Trustee Council Office, available upon request.

III. Distribution of Annual Reports

Annual reports shall be kept on file as public documents at the Trustee Council Office, available upon request. Annual reports shall also be posted on the Trustee Council's website at www.oilspill.state.ak.us.

NOTE: Will replace, before finalize procedures, with a more current example. SS

Exxon Valdez Oil Spill
Restoration Project Final Report

Comprehensive Community Plan for the Restoration of Archaeological Resources in Prince William Sound and Lower Cook Inlet

Restoration Project 96154
Final Report

Lora L. Johnson

Chugach Development Corporation
560 East 34th Avenue, Suite 201
Anchorage, Alaska 99503-4196

November 1996

(+ non-discrimination statement on back)

Comprehensive Community Plan for the Restoration of Archaeological Resources in Prince William Sound and Lower Cook Inlet

Restoration Project 96154
Final Report

Study History: Project 96154 was the second phase of an effort to address community concerns about restoration of archaeological resources. The first phase was Project 94007A. In the final report for Project 94007A, 1994 Spill Area Site and Collection Plan, the Alaska Department of Natural Resources recommended a regional repository and local display facilities in the Prince William Sound and lower Kenai Peninsula regions. Project 96154 was a one-year project that further explored this recommendation and other alternatives.

Abstract: The author contacted about 40 organizations with an interest in cultural resources in Prince William Sound and lower Cook Inlet and compiled profiles for each organization. The profiles covered such topics as the organization's facilities, governance, and programs. In addition to the organizational profiles, the final report includes an inventory of 1,489 spill-related catalogue entries (artifacts and scientific samples) from the Prince William Sound and lower Cook Inlet regions. These items were collected during the cleanup, damage assessment and restoration phases of the spill. The inventory includes a brief description of the item, the site from which it was taken, and its present location. The author estimates that the total storage requirement for these items is 400 cubic feet and could be accommodated in a 100 square-foot space. The final report also evaluates eight facility scenarios and recommends the construction of archaeological repositories in each of the eight spill-affected communities in the project area, that is, Valdez, Cordova, Chenega Bay, Tatitlek, Seward, Seldovia, Port Graham and Nanwalek. Other alternatives include one or two regional repositories, facilities in each community to display spill-related archaeological materials, traveling displays of archaeological materials, and use of an existing museum as a repository.

Key Words: Archaeological artifacts, archaeological collections, archaeological repositories, curation, *Exxon Valdez*, lower Cook Inlet, Prince William Sound.

Project Data: *Description of data* - The inventory of archaeological catalogue items was compiled from a variety of sources, including the University of Alaska Museum's catalogue of archaeological collections, an inventory supplied by the U.S. Forest Service, and inspection by the author. *Format* - The data was entered into an Excel spreadsheet and reproduced in the appendix to Part I of the final report. *Custodian* - Contact Lora Johnson, Chugachmiut, 4201 Tudor Centre Dr., Suite 210, Anchorage, Alaska 99508, (work phone: (907) 562-4155, fax: (907) 563-2891). *Availability* - Copies of the inventory of archaeological catalogue items can be provided on a diskette.

Citation: Johnson, L. 1996. Comprehensive community plan for the restoration of archaeological resources in Prince William Sound and lower Cook Inlet, *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 96154), Chugach Development Corporation, Anchorage, Alaska.

ATTACHMENT B

EVOS ANNUAL PROJECT REPORT

All recipients of funds from the *Exxon Valdez* Oil Spill Trustee Council must submit an annual project report in the following format by September 1 of each fiscal year for which project funding is received, with the exception of the final funding year in which a final report must be submitted. Satisfactory review of the annual report is necessary for continuation of multi-year projects. Failure to submit an annual report by September 1 of each year, or unsatisfactory review of an annual report, will result in withholding of additional project funds and may result in cancellation of the project or denial of funding for future projects.

PLEASE NOTE: Significant changes in a project's objectives, methods, schedule, or budget require submittal of a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.

Project Number:

Project Title:

PI Name:

Time Period Covered by Report:

Date of Report:

1. Work Performed: Summarize work performed during the reporting period, including any results available to date and their relationship to the original project objectives. Describe and explain any deviation from the original project objectives, procedural or statistical methods, study area, or schedule. Also describe any known problems or unusual developments, and whether and how they have been or can be overcome. Include any other significant information pertinent to the project.

2. Future Work: Summarize work to be performed during the upcoming year, if changed from the original proposal. Describe any proposed changes in objectives, procedural or statistical methods, study area, or schedule. [**PLEASE NOTE**: Significant changes in a project's objectives, methods, schedule, or budget require submittal of a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.]

3. **Coordination/Collaboration:** Describe efforts undertaken during the reporting period to achieve the coordination and collaboration provisions of the proposal, if applicable.

4. **Community Involvement/TEK & Resource Management Applications:** Describe efforts undertaken during the reporting period to achieve the community involvement/TEK and resource management application provisions of the proposal, if applicable.

5. **Information Transfer:** List (a) publications produced during the reporting period, (b) conference and workshop presentations and attendance during the reporting period, and (c) data and/or information products developed during the reporting period. [**PLEASE NOTE:** Lack of compliance with the Trustee Council's data policy and/or the project's data management plan will result in withholding of additional project funds, cancellation of the project, or denial of funding for future projects.]

6. **Budget:** Explain any differences and/or problems between actual and budgeted expenditures, including any substantial changes in the allocation of funds among line items on the budget form. Also provide any new information regarding matching funds or funds from non-EVOS sources for the project. [**PLEASE NOTE:** Any request for an increased or supplemental budget must be submitted as a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.]

Signature of PI: _____

Project Web Site Address: _____

SUBMIT ANNUAL REPORTS ELECTRONICALLY TO katharine_miller@oilspill.state.ak.us. THE REPORTS WILL BE POSTED ON THE TRUSTEE COUNCIL'S WEB SITE AND SHOULD ALSO BE POSTED ON THE PI'S WEB SITE. The subject line of the e-mail transmitting the report must include the project number and the words "annual report" (e.g., "03562 Annual Report"). Electronic reports must be submitted either as an Acrobat Portable Document Format (PDF) file or word processing document with any figures and tables imbedded. Acrobat PDF 4.0 or above file format must be used, preferably in 'formatted text with graphics' (called "PDF normal" under Acrobat PDF 4.0) format. Minimally, "PDF searchable image" (called "PDF original image with hidden text" under Acrobat PDF 4.0) may be used if pre-approved by the Trustee Council Office. In either case, the PDF file must not be secured or locked from future editing, or contain a digital signature from the principal investigator.

Distribution of Final Reports

The Alaska Resources Library and Information Services (ARLIS) receives and distributes 18 bound copies and 2 camera-ready copies of the final reports as follows:

ARLIS collection (6 bound and 1 camera-ready copy)*
Alaska State Library (4 bound copies)**
Holmes Johnson Library (Kodiak) (1 bound copy)
National Marine Fisheries Service Auke Bay Laboratory (1 bound copy)
National Library of Canada (Ottawa) (1 bound copy)
National Technical Information Service (1 bound copy and 1 camera-copy for reproduction upon request)
University of Alaska Anchorage (1 bound copy)
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University of Washington Library (1 bound copy)
Valdez Consortium Library (1 bound copy)

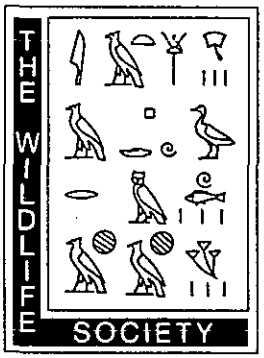
The chairman of the Lingering Oil Effects Subcommittee receives 1 bound copy of each final report.

*ARLIS distributes its bound copies as follows:
1 to the Trustee Council's Science Director
1 to the Trustee Council's official record
4 to the ARLIS permanent collection

** The Alaska State Library distributes its copies as follows:
Alaska State Library
Alaska Historical Library
E. E. Rasmuson Library (University of Alaska Fairbanks)
Library of Congress

NOTE: Only cover page is attached here. Full document available from TC office. Full document will be appended to final version of procedures. SS

MANUSCRIPT GUIDELINES FOR THE *JOURNAL OF WILDLIFE MANAGEMENT*



By
John T. Ratti and Loren M. Smith
1998 *Journal of Wildlife Management* 62 (1, Supplement)
The Wildlife Society, Inc., Bethesda, Maryland

The purpose of this policy is to facilitate full and open access to, and confident use of, the data and information used in and produced by programs of the Exxon Valdez Oil Spill Trustee Council, including the Gulf of Alaska Ecosystem Monitoring and Research (GEM) Program.

The *Exxon Valdez* Oil Spill Trustee Council/GEM Data Policy has the following objectives, to:

1. Make information from projects available to other scientists and to the general public in a well documented and understood form in a timely manner.

2. Protect the right of investigators who collect data, develop models, or who apply models to generate significant new insight to be cited whenever the data, models or insights are used. Description and interpretation of the results of investigations are the privilege and responsibility of those who collect data or develop and apply models. However, investigators must not unreasonably impede the exchange of information essential to comparative and interdisciplinary research, interpretation, and synthesis.

3. Ensure that data and samples are collected in a manner that will yield accuracy and precision sufficient for the objectives of each project, and for anticipated comparisons and syntheses between projects. It is fundamental to any science-based program that high-quality data be collected. While the primary responsibility for this always belongs to the Principal Investigator, this policy must provide guidance, coordination and monitoring, particularly for situations where the level and type of data management appropriate for an individual project may not be the same as that required by an interdisciplinary program of large geographic and temporal extent.

4. Preserve all data collected under Trustee Council funding (except that specifically exempted by program administration) in an archive accessible to the scientific community in a timely manner. Data to be archived include compilations, analyses and syntheses of previously recorded data, even though the data themselves may be in the public domain. The archive and the means for retrieving data must foster both disciplinary and interdisciplinary data syntheses.

5. Preserve models developed with Trustee Council funding in an archive accessible to the scientific community. The inputs and results of key numerical experiments employing models should also be archived if they have been the basis for publications. Including models in the archive is necessary to realize maximal benefits from the considerable investment anticipated for modeling.

6. Encourage the voluntary release of data and other products of Trustee Council-funded research by Principal Investigators at any time before the deadlines given in this document.

The policy has been developed in accordance with known current guidelines and/or standards for environmental data collection activities. In practice, the data policy must comply with federal and state law and be consistent with that of sponsoring agencies. If any material differences exist between the data policy and federal or state law, or policies of a sponsoring agency, the Principal Investigator must identify the differences to Trustee Council program administration for resolution.

To ensure that these policies will be followed for all projects:

1. All Principal Investigators will agree to follow Trustee Council/GEM data policies as a condition of receiving funding.

2. The Trustee Council Executive Director will be notified of any instances where Trustee Council/GEM data policies are not being followed, and which cannot be resolved by the parties directly involved. The Trustee Council's Executive Director will review the situation and recommend a course of action, which could include notification of parent agencies of principal investigators who have not complied with the data policy and/or preclude funding for future projects.

Data Management Plan

Once the Trustee Council approves project funds and the Trustee Council's Executive Director provides spending authorization, the Trustee Council/GEM Data Systems Manager will contact the principal investigator (PI) to establish a Data Management Plan (DMP). The DMP will supplement information in

the project proposal developed by the PI. The DMP will include procedures to process, format, document, and migrate all data to archives identified by the Data Systems Manager, and identify a schedule for delivery.

The PI must address the following considerations in describing the methodologies for collection and analysis:

1. Identification of measurements to be made and the anticipated precision and accuracy of each measurement.
2. A description of the sampling equipment sufficient to permit an assessment of the anticipated raw-data quality. Typical descriptions will include where appropriate: navigation, timekeeping, sensor make and model, net opening and mesh size, rate of retrieval, mooring configuration, and similar information appropriate to the types of samples to be collected. Where the data collection equipment is well known or documented in generally available technical reports or the published literature, the need for documentation will be substantially reduced and may be satisfied by identifying the system or referring to the appropriate documentation.
3. A description of the analysis methodology sufficient to permit an assessment of the anticipated analyzed-data quality. Typical descriptions will include where appropriate: filter size and type, sample preservation technique, counting method, numerical algorithm, incubation procedure and similar details as appropriate to the measurements planned.
4. A discussion of the means by which the measurements to be taken could be compared with historical observations or with regions which are thought to have similar ecosystems. Measurement techniques should be consistent with techniques used to collect the existing data unless there is significant scientific justification for change. When new techniques are adopted, methods for relating the new data to existing data should be developed.

DMPs will be updated yearly for continuing projects, and for the year following completion of data acquisition, until all data resulting from the project enters the archive(s).

Data Processing Policy

The PI(s) responsible for collecting data must apply approved quality assurance/quality control (QA/QC) protocols to these data sets.

Within 60 days after data or sample collection is completed, the PI must submit to the Data Systems Manager a detailed inventory of measurements made or samples collected. This inventory will include the time and location of each measurement or sample, as well as the nature of the measurement or planned analyses of the sample.

Data Preservation Policy

By court order, all samples and documents collected as part of any Trustee Council-sponsored restoration program, including GEM, must be retained. All data normally must be preserved, and requests to destroy samples and documents must follow the Trustee Council's "*Procedures for State Agencies and Their Contractors for Destroying Documents or Physical Evidence Related to the Exxon Valdez Oil Spill.*" Documents (including written, electronic, photographic and magnetic) or physical evidence (such as tissue samples) must be preserved, unless authorization is given by the Department of Law to destroy items no longer necessary for restoration or other purposes.

Policy for Data Submission to the Trustee Council's Data Archive

Some data from routine monitoring activities will be available to the archive regularly and in real or near-real time. The PI should submit results of measurements that do not require time-consuming analyses within six (6) months after the completion of data collection. All other measurements should be made within 12 months after field collection, or submitted with the final report for the project, whichever occurs first. Categorization of data and identification of an applicable schedule will be identified in the DMP. The PI will advise the Data Systems Manager if these schedules cannot be met.

No data file, data set, data layer, or database be accepted by or made available via the data archive without appropriate supporting metadata ("data about data"). The metadata format will be compliant with the Federal Geographic Data Committee (FGDC) standards. In coordination with the Data Systems Manager, the PI(s) will include, at a minimum, the following information with each data set archived:

1. collection dates and times (Greenwich Mean Time [GMT]);
2. precise location (decimal degrees longitude and latitude, depth(s))
3. data collection methods;
4. data format (e.g., ASCII, Excel spreadsheet, ARC/INFO coverage, etc.);
5. data collection problems, data processing problems, bad data flags, data dropouts, and other quality control factors identified by the PI(s);
6. instrument descriptions and calibrations;
7. collection site descriptions and conditions; and
8. conditions for use and citation

Data sets may have specific additional guidelines; the PI(s) will accommodate whatever special considerations are necessary. The Data Systems Manager will provide data information sheets to help the PI to encapsulate this information and include it with the data when migrated to the data archive. The PI(s) will be required to submit metadata information to other appropriate data clearinghouse(s) identified by the Data Systems Manager.

The Federal Ocean Data Policy requires that appropriate ocean data and related information collected under federal funding be submitted to and archived by designated national data centers within specified time periods. PI(s) will be required to submit their data sets to appropriate national data center(s) identified by the Data Systems Manager.

Data Model Archive Policy

The Trustee Council's data archive will also include data models, and products or results of modeling. Such products will be chosen by the Trustee Council's Scientific and Technical Advisory Committee (STAC) for archiving if they are central to achieving the large-scale goals of a Trustee Council study, and/or if they will be useful to a substantial group of PI's for Trustee Council-funded projects. The products will be identified in the DMP. The DMP will also specify deadlines for submission and the length of the proprietary period. Other models and/or model products can be submitted to the data archive if they are likely to be useful to other investigators and the scientific community.

Archived computer models should include source code in a commonly used scientific language. Documentation, sufficient to allow use of the model by persons having the knowledge and abilities typical of numerical modelers, must be submitted. Model products must include sufficient explanation so that persons having knowledge and abilities typical of Trustee Council-funded investigators can understand them.

Data Dissemination Policy

Data collected under Trustee Council funding is considered public information.

Data from routine monitoring activities will be available regularly and in real or near-real time. The PI retains exclusive analysis and publication use of the non-routine data and developed models during the first year following data collection or model development. Such information will be available to other Trustee Council-funded investigators after that period. All data will be made available to other users within two (2) years after data collection or model development. However, if data or models are requested pursuant to the Freedom of Information Act or the Alaska Public Records Act, the Trustee Council is required to release this information. The release of data or models to third parties will stipulate that the PI and the Trustee Council program will be fully acknowledged in any subsequent publications in which any part of the data or models are used.

The PI may own a copyright on the publication of the processed data developed or bought under Trustee Council funding. The Trustee Council reserves a royalty-free, nonexclusive, and irrevocable license to reproduce, publish, or otherwise use, and to authorize others to use, for Trustee Council purposes, the copyright in any work developed under an award, or any rights of copyright purchased by the PI with Trustee Council funding. Any such publication will include a notice identifying the award and recognizing the license rights of the Trustee Council program under this clause. This paragraph will have no force and effect for the processed data not published by the PI.

Data Citation Policy

The Trustee Council retains the right to analyze, synthesize and publish summaries of the data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, PI(s) publishing manuscripts in open literature, including refereed scientific journals, or making other public presentations, will acknowledge that the research was conducted with Trustee Council funding.

Persons who acquire data, models, or model products from the Trustee Council's data archive are responsible for communicating with the originating investigator(s). If a substantial use of the data is planned, collaboration and co-authorship with the originating PI(s) is expected for any resulting publications. However, originating PI(s) may not unreasonably impede use or publication of archived data, models, or model applications, provided that they receive due credit for their contribution.

Data Liability Policy

The data sets are only as good as the quality assurance and quality control (QA/QC) procedures applied to each project. The user bears all responsibility for its subsequent use or misuse in any further analyses or comparisons. The Trustee Council does not assume liability to the recipient or third persons, nor will the Trustee Council reimburse or indemnify the recipient for its liability due to any losses resulting in any way from the use of this data set.

Effective Date: October 1, 2002

STATUS OF INJURY

Exxon Valdez Oil Spill Trustee Council

441 W. 5th Ave., Suite 500 • Anchorage, Alaska 99501-2340 • 907/278-8012 • fax 907/276-7178

MEMORANDUM

TO: Trustee Council members

FROM: Molly McCammon
Executive Director

DATE: July 2, 2002

RE: Status of Injured Resources

Attached you will find a memo from Dr. Spies responding to public comments on his proposed revisions to the Update on Injured Resources and Services. Based on public comment and Dr. Spies' response, these are the options for amending the April 30, 2002 Draft Update you may want to consider at the July 9 meeting. The first column is Dr. Spies' recommendation. The second column contains other options.

Black oystercatcher	**Keep as Recovered**	Move to Recovering
Clams	**Keep as Recovering**	Move to Not Recovering
Harlequin ducks	Move to Recovering	**Keep as Not Recovering**
Killer whales	Keep as Recovered Keep revised recovery objective	**Move to Recovering** **Go back to original recovery objective of prespill population as proxy for baseline**
Pacific herring	Keep as Recovering	**Move to Not Recovering**
Pink salmon	**Keep as Recovered**	Move to Recovering
Subtidal communities	**Keep as Recovered**	Move to Recovering

For the most part, these options represent judgment calls on the part of you as Trustees. I have also considered whether or not to change the recovery categories or definitions. Based on research of other attempts to define "recovery," I don't believe it is necessary to change the Trustee Council's categories at this time. I have closely reviewed the public

comments and the information provided by Dr. Spies, and I believe the current categories are sufficient for our present use. My recommendation would be to approve Dr. Spies' April 2002 Update with three changes highlighted in bold type. This would require some revisions to the text of the update on harlequins, killer whales and herring. We will also consider adding to the update some additional explanatory text from Dr. Spies' recent memo that may help the public better understand the status of some resources.

I also wanted to note public concerns that in the future the GEM Program might ignore resources still experiencing effects from the oil spill or those species that are important to the public. That should certainly not be the case. The GEM Program Document includes the Trustee Council's commitment to following oil spill effects through recovery. Additionally, an ecosystem-based monitoring and research program will be a legacy to benefit all the resources people care about.

APPLIED
marine
SCIENCES

MEMORANDUM

TO: *Exxon Valdez* Oil Spill Trustee Council

FROM: Dr. Robert B. Spies
Chief Scientist

DATE: July 1, 2002

RE: Issues in Revision of the Injured Resources Status Report

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At the Trustee Council meeting on June 14th, you received both oral testimony and written comments from a variety of Alaskans on my proposed revisions to the Update on Injured Resources and Services, April 30, 2002 draft. You requested that I address the major issues raised by public review of the proposed revisions. In addition, the Executive Director, Molly McCammon, posed some questions to you, the answers to which may help in resolving some of these issues. Since some of these are policy issues that lie within your purview, I will find your responses quite useful in helping us through this process. In the meantime, at the specific request of Trustee Pearce, I am providing responses here to the variety of issues that have been raised in the public comments.

The proposed revisions to the Council's Update on Injured Resources and Services raise again the controversies involved in making such judgments, lead us to reexamine the basis for declaring an injury, and revisit the emotions invoked by the tragic events of the 1989 oil spill. More fundamentally, the revisions highlight the standards for listing or upgrading resources and our position with regard to uncertainties, which are numerous and pervasive. In addition, you have a role in making policy; my role is to provide you independent scientific advice.

To start, it is useful to provide a context and pose some issues. The first issue is that of my role. I am to provide independent scientific advice to you as a basis for making your decisions. I do this by applying my knowledge and judgment to the information I have available. I do not act as the head of a committee, but as an individual scientist in providing you this advice, after reviewing the evidence with those most involved in monitoring these resources. Due to the complicated nature of spill injury and recovery, the kinds of evidence that are available, and what we do not know, there is considerable judgment involved in my recommendation for placing any nominated resource on the list of injured resources and in determining what category it should be in after it is listed. There will be controversy in any listing or any change in listing as there may not be total consensus on how to define recovery. Part of my role is to be open to various points of view and consider any new data or interpretations that may be

4749 Bennett Drive, Suite L Livermore CA 94550 925.373.7142 Fax 925.373.7834

forthcoming during this process. However, in the end I sift through and weigh the evidence and make a judgment and recommendation based on my knowledge and experience. I endeavor not to be swayed by public pressure and controversy, but to act on the basis of facts and independent judgment.

A second issue that deserves consideration as context and guidance in this process is our position towards uncertainty. This issue is at the heart of many resource policy decisions and continues to fascinate many of us who are engaged in some aspect of the decision-making process. Many members of the public clearly recognize the use of the precautionary principle, as is evident in the written comments (e.g., the comments from Michelle Nordhoff of the Alaska Center for the Environment). I have always endeavored to use the precautionary principle in approaching questions of resource policy. However, even informed by this guiding principle, the range of outcomes and judgments is considerable. Many of the comments from the public express a wish not to change resource status unless there is incontrovertible evidence of recovery and no remaining doubt. At the other end of the spectrum, continuing to list a species as injured in the absence of a reasonable body of evidence runs the risk of a potential loss of credibility with the scientific community and other members of the public. As the speculative nature of the injury or lack of recovery increases, there reaches a point where some judgment can be applied, even while remaining in the realm of the precautionary.

In my judgment the list in some direct sense should convey to the public the nature of the injured system. Calling only one or two species recovered when there is abundant evidence of a functioning ecosystem throughout the spill area provides a picture of undue alarm. There is identifiable oil in the system, somewhat more than we expected, but still a small fraction of what was spilled. We are investigating whether the remaining oil is a problem for clams, sea otters, and harlequin ducks. There is still rebound from the spill in some populations, and there are still species that we should not call recovered yet in order to be precautionary.

There is also the question of what is a reasonable investment of effort to periodically determine recovery status and to try to resolve the questions of continued injury. In many instances more study may not resolve basic uncertainties in injury and recovery. This is due to the lack of understanding of the extent of the original injury, the extent to which positive fluctuations in the ecosystem have enabled recovery from this injury, or the extent to which negative fluctuations have caused additional decreases. Herring is a good example of this. How much of the differential between the prespill population of herring (near record high levels in 1989 and 1990) and its current status is due to oil, and how much is due to a series of poor plankton years in the early 1990s, the effects of disease brought on by stresses in addition to oiling, or the effect of predators? No one has a clear idea of this, and there is no convincing way to demonstrate what the herring population would be in Prince William Sound had the spill not occurred. In my opinion more study will not resolve these questions in the near term; all we can do is wait for the next dominant year class to appear, which forms the basis for our recovery objective for herring. In other cases where

the questions may be answered, there is research underway, such as for clams, that will help determine resource status.

Below, I will provide commentary on several species for which there was considerable public comment. I hope that these comments will be useful in your upcoming decision.

Killer whales

There was considerable comment from the public on killer whales, mainly to the effect that this species should be listed as "recovering" and not "recovered". There were also comments that the recovery objective should go back to the 1994 version, which calls for a return to prespill numbers (36 individuals for the AB pod), as opposed to a stable or increasing population as a recovery objective. There were also some comments recommending that AT1 pod be added to the injured list.

With this species there is considerable uncertainty about the nature of the original injury, or even if there was an oil effect. There are valid arguments on both sides of this question. I have never found the evidence that killer whales were negatively affected by the spill very compelling. No one has ever been able to put forth a convincing argument on how whales in 1989 could be dosed with enough fresh oil to kill 6 members of the AB pod, let alone an additional 7 individuals in 1990 when there was virtually no floating oil. However, I recognize that I could be wrong, and I believe the Trustee Council was justified in taking a precautionary approach to this injury in 1994 by including killer whales on the injured resources list. The AB pod has been the only resident pod in the area to experience these kinds of losses. Accepting that there was a loss of 13 individuals from AB pod in 1989-1990 due to the oil spill, the Trustee Council adopted a criterion of recovery to prespill levels in this pod in 1994. In 1999 that recovery objective was changed to "an increasing or stable population of AB pod relative to other resident pods." I have proposed keeping this recovery objective, although dropping the reference to other resident pods since they are so different in size and structure compared to the AB pod and the data on them is much sketchier. However, there is justification for either retaining the current recovery objective or reversing the Trustee Council decision in 1999 and returning to the original objective. Since the 1990s the pod has steadily increased in numbers and has achieved a stable or increasing status. If the current recovery objective is kept, killer whales technically could be considered "recovered," although waiting for a longer-term trend would be possible. If the recovery objective was changed back to "prespill numbers," killer whales would definitely be kept in a "recovering" status.

There is no evidence that the AT1 transient group experienced negative effects from the oil spill. However, because of interest in this group and concern about its health, we have reported on its population status and trends.

Subtidal communities

One comment was received asking that subtidal communities continue to be considered "recovering" until they are proven to be "recovered" with new data.

As I mentioned in my proposed revisions, early studies (1989-1991) showed the presence of very little oil in the subtidal zone, with only small concentrations remaining through 1995. Those amounts would be even less today. Differences between fauna in oiled areas compared to fauna in unoiled areas still remaining in 1995 were recently acknowledged likely to be caused by natural factors. In my judgment, no new evidence is warranted to assess recovery. For that reason, I continue to recommend that these communities be considered "recovered" from the effects of the oil spill.

Herring

There were a significant number of people who argued that herring should be returned to a "not recovering" status because a strong year class of herring has not emerged as expected following the 1999 status revision.

As indicated above, there are numerous factors to consider both in the determination of the original injury and the recovery status of this species. With this species there is a stronger case for the oil spill causing a significant effect on the population. Oil did cause abnormalities in developing embryos in 1989, and a large proportion of the herring spawn was in the trajectory of the spill. When the 1989 year class recruited to the population in 1992 and 1993, overall recruitment was very weak. Poor plankton production in the intervening years and competition with the strong 1988 year class probably played a role in addition to oiling effects. However, no one knows to what extent each of the factors contributed. In addition, the average size-at-age of herring had been decreasing since the mid-1980s as the population was rising, and the population had been reduced 6- or 7-fold in 1993 and 1994 associated with, but not necessarily caused by a viral disease.

Once again accepting that there was a link to oil as a precautionary approach, the Trustee Council adopted a recovery objective that would have the emergence of a strong year class of herring as constituting recovery. The population was showing signs of recovery in the late 1990s. The herring fishery briefly reopened, having been closed after the 1993 crash. This prompted a change in classification to "recovering". However, since 1998 and up until only very recently, there have been no further signs of recovery. Given this situation, it may be justified to lapse this population into the "not recovering" category from its 1999 designation as "recovering".

One promising recent and preliminary finding is that a relatively small sample taken to assess the presence of disease had over 70% of the catch as newly recruited 3 year olds. This may be the next large year class provided the preliminary findings are upheld. The call could go either way with herring: either retaining the species in the "recovering" category or lapsing it to the "not recovering" category.

Pink salmon

A small number of people argued that pink salmon had not recovered, mostly based on lack of proof to the contrary. There was also concern about changing the recovery objective.

Like most other resources, this too is a complicated case. The original injury was to the growth of juveniles in the marine environment and to developing embryos in the intertidal mouths of oiled streams.

The injury to juvenile growth was likely the most significant to the population, if we can accept the modeling done by Hal Geiger from Alaska Department of Fish and Game. Since the original exposure to fresh oil in 1989, pink salmon juveniles have had about 5 subsequent life cycles. Surely other factors have intervened to control salmon populations since 1989, making it highly unlikely that oil exposure is continuing to affect juvenile growth. Can we prove that there is no lingering effect of the spill? No, but proving any negative is a logical impossibility. Can anyone prove that there is a lingering effect from juvenile injury in 1989? No, they cannot. At some point following several life cycles (that have included some quite successful years), the injury must be considered only negligible.

Considering the other aspect of injury, more apparent mortality in pink salmon embryos in the oiled streams in 1990-1993 (compared to embryos in unoiled streams), things become a little murkier. An argument has been made that the way in which the embryos were collected and counted introduced biases in the original mortality estimates and exaggerated the injury. The re-emergence of the apparent effect of differential mortality in embryos in 1997 seems to add some credence to the argument. On the other hand, a Trustee Council funded study showed that hatchery-spawned eggs showed the same effects as those displayed by eggs in their native streams, thus seeming to reinforce the reality of the injury. The only way to sustain such an injury over time would be a continuing genetic effect from the original injury or continuing exposure of the eggs in the originally oiled streams. A continuing genetic effect does not have experimental support for more than one generation. In fact, there is a well-known phenomenon of lethality for most mutations that would lead to extermination of the genetic defects in a generation.

Trustee Council sponsored research investigated mechanisms of continuing exposure of pink salmon embryos to oil. The research results found that it was possible for embryos to be exposed to oil even ten years after the spill, but even the cumulative exposure is minimal and likely to be diminishing over time. Since only one of the 6 salmon streams (chosen for analysis because they were the most likely to show residual oiling) recently measured for hydrocarbons had any bioavailable hydrocarbons, and the concentrations measured were at least 1000 times less than those known to cause sublethal effects in this species, continuing exposure of embryos to oil has been largely discounted as a significant mortality factor for pink salmon. I recommended reclassifying pink

salmon as recovered in 1999, but the Trustee Council decided to be more precautionary in its views. I am making the same recommendation this year. In my judgment it severely strains credulity to maintain that there is still an injury. Any declines in wild pink salmon stocks are likely due to factors other than oiling, such as competition from hatcheries.

Clams

One member of the public asked that clams be reclassified as "not recovering." I do not agree with that assessment. Data from a NOAA study clearly show that clams have made progress towards recovery since injury from the spill in 1989, but have not recovered. It may be true that there have not been recent signs of additional recovery. However, it would not be true to say that some recovery has not occurred. For that reason, I continue to believe that clams are "recovering" from the effects of the oil spill.

Black oystercatchers and other intertidal organisms

There was a comment from a member of the public to the effect that since the habitat of black oystercatchers was still contaminated, these and possibly some other intertidal species should not be considered to be recovering or recovered.

This is basically a "how clean is clean" question. I believe that we should base the recovery status of a species primarily on it status biologically or direct proof of oil exposure, not on the "possibility" of oil exposure. The results of a Trustee Council sponsored study of black oystercatcher reproduction were received after the last injury update. The investigators concluded that oil was not having a continuing effect on this species. Can we say that no oystercatcher is exposed to oil? No, but it is highly unlikely that the exposure would be significant enough to cause an effect. I therefore continue to recommend this species be considered "recovered" from the effects of the oil spill.

Harlequin ducks

Public comment indicated that harlequins should not be considered "recovering" since they may still be exposed to oil and female reproduction may still be affected by oil exposure.

There are several significant remaining uncertainties with regard to the injury in harlequin ducks. First, there appear to be subtle differences in the suitability of habitat on eastern and western portion of Prince William Sound that may be confounding any remaining effects of oil on demographics and populations. Second, the indicator of oil exposure, P4501A induction, also is an indicator of exposure to PCBs. This may also confound to some degree our ability to determine the effects of remaining oil.

The recovery objectives for this species include:

1. A lack of exposure to hydrocarbons. *This objective appears not to have been met as there are continuing indications of low-level oil exposure.*

2. A stable or increasing population. The survey data clearly indicate increases in all areas of the sound in winter, with oiled areas increasing at a slower rate compared to unoiled areas. In winter, when the largest numbers of birds are using Prince William Sound, the trend in the population is definitely rising. Boat surveys carried out at other times of the year in various years since 1995 show mixed results, some with no trends, some with increasing trends, and some with decreasing trends. *So, this objective has been partially met.*

3. Demographics between oiled and unoiled areas should be similar. The latest studies indicate that most demographic measures are similar except for the winter-time survival of female harlequin ducks, which is lower in oiled areas. Although lower survival of females in winter in the oiled parts of Prince William Sound is a very significant difference in demographics, *this criterion has been partially met.*

Research results show that there has been some movement towards "recovery" in this species. Is this progress enough to merit placing this species in the category of "recovering" rather than "not recovering"?. That is strictly a judgment call. In this sense harlequin ducks are broadly similar to herring and killer whales: there is progress towards the recovery objectives, but it is not clear that they will be fully met any time soon.

Exxon Valdez Oil Spill Restoration Plan

DRAFT Update on Injured Resources and Services
April 30, 2002

Exxon Valdez Oil Spill Trustee Council
441 West 5th Avenue, Suite 500, Anchorage, AK 99501-2340
907-278-8012 800-478-7745 (in Alaska) 800-283-7745 (outside Alaska)

RESOURCES AND SERVICES INJURED BY THE SPILL

RESOURCES IN BOLDFACE HAVE BEEN RECATEGORIZED ON THIS RECOVERY LINE DURING THE MOST RECENT UPDATE (APRIL 30, 2002)

NOT RECOVERING
Species are showing little or no clear improvement from oil spill injuries.

Common loon
Cormorants (3 spp.)
Harbor seal
Pigeon guillemot

RECOVERING
Substantive progress is being made toward recovery objective. The amount of progress and time needed to achieve recovery vary depending on the resource.

Clams
Designated Wilderness Areas
Harlequin duck
Intertidal communities
Marbled murrelets
Mussels
Pacific herring
Sea otter
Sediments

RECOVERED
Recovery objectives have been met

Archaeological resources
Bald eagle

Black oystercatcher
Common murres
Pink salmon
Killer whales (AB pod)
River otter
Subtidal communities
Sockeye salmon

RECOVERY UNKNOWN
Limited data on life history or extent of injury; current research inconclusive or not complete.

Cutthroat trout
Dolly Varden
Kittlitz's murrelet
Rockfish

HUMAN SERVICES
Human services that depend on natural resources were also injured by the oil spill. These services are each considered to be recovering until the resources on which they depend are fully recovered.

Recreation & tourism
Commercial fishing
Passive uses
Subsistence

UPDATE ON INJURED RESOURCES AND SERVICES

Introduction

History and Purposes of the List

In November 1994, the *Exxon Valdez* Oil Spill Trustee Council adopted an official list of resources and services injured by the spill as part of its *Restoration Plan*. This list has served three main purposes in the Restoration Program:

1. It has highlighted injuries caused by the oil spill and cleanup efforts and helped the Trustees and the public track the status of important fish, wildlife, and other resources and services. The fish and wildlife on this list are thought to have suffered population-level or sublethal injuries, but the list does not include every species or resource that suffered some

degree of injury. For example, carcasses of about 90 different species of oiled birds were recovered in 1989, but only 10 species of birds are on the list of injured species.

2. It has helped guide the *Restoration Plan*. This was especially important in 1994 when the plan was first adopted, but the list still serves to highlight resources that are in need of consideration.
3. Finally, taken as a whole, the list of injured resources has helped the Trustees and the public track recovery of the overall ecosystem and the functions and human services that it provides.

The *Restoration Plan* states that the Injured Resources and Services list will be reviewed periodically and updated to reflect results from scientific studies and other information. With each review, a resource's progress toward a recovery objective is evaluated. The recovery objectives have been set to be as concrete and measurable as possible. However, they may be changed to reflect new insights about the nature of the injury and the best ways to evaluate recovery status.

The Injured Resources and Services list was first updated in September 1996. At that time the bald eagle was upgraded from recovering to recovered. In March 1999, a major review of recovery objectives and status occurred and several more changes were made. River otters were then considered to be recovered, and five resources—black oystercatchers, clams, marbled murrelets, Pacific herring, and sea otters—were upgraded to recovering. One resource, the common loon, was moved from recovery unknown to not recovering. Five resources remained as recovery unknown. All four human services were classified as recovering.

In 2002, more than 13 years after the spill, recovery continues to progress and more changes have been made to the list. Seven more species or resources have been moved to the recovered category: archaeological resources, black oystercatchers, common murres, killer whales, subtidal communities, sockeye salmon and pink salmon. In addition, harlequin ducks have been moved from the not recovered to the recovering category, and designated wilderness areas have been moved from the recovery unknown to the recovering category.

The 1994 *Restoration Plan* provides that the Injured Resources and Services list can be updated any time new information becomes available. The next major evaluation of changes in recovery status for all injured resources and lost or reduced services likely will be in 2006, 15 years after the 1991 settlement between the governments and Exxon and initiation of the restoration program.

How to Interpret this List

The assignment of resources to various categories continues to be based on judgements made after weighing the available evidence, including:

- estimates of population sizes and trajectories in the spill area;
- comparisons of population estimates in oiled and unoiled areas of the northern Gulf of Alaska;

- whether there has been continued exposure to residual oil in the spill area; and
- whether sublethal or chronic injuries persist or show improvement.

Some of the factors involved in making judgments about recovery status include:

1. *Uncertainties in population estimates.* Because of the variability in animal distributions and the challenges of getting accurate counts, especially of highly mobile fish, birds and marine mammals, most estimates of population size have wide ranges. For example, ranges that are between 40% greater or smaller (or even more) than the true population size will result from many census techniques. This range can be narrowed, but costs escalate with the increasing effort to obtain greater accuracy.

2. *Lack of prespill data.* Many of the resources affected by the spill had limited or no recent data on their status in 1989. In addition, some of the available pertinent data was the result of limited sampling and had wide ranges in the population estimates. Having such patchy data on resources made it difficult to accurately assess initial injury. In turn, any uncertainties in injury inevitably lead to uncertainties in estimating recovery.

3. *Interaction of spill and natural factors.* It is increasingly difficult to separate what may be lingering effects of the spill from changes that are natural or caused by factors unrelated to the oil spill. In fact, what is often observed appears to be an interaction between oil effects and natural changes, such as the effects of the 1998 *El Niño* on common murres in the Barren Islands which were recovering from oil spill impacts. We now understand much more about long-term changes in climate in the northern Gulf of Alaska and how these changes affect marine species.

4. *Emergence of new effects.* Since the *Exxon Valdez* oil spill affected an area rich in wildlife and was so well studied, it would not be surprising that there are findings without precedent in the scientific literature on oil effects. One example of such an unprecedented effect is the sensitivity of Pacific herring and pink salmon to low concentrations of weathered oil (Carls et al., 1999; Rice et al., 2001). We cannot discount evidence for an injury just because it had never been encountered in the aftermath of other spills.

Ecosystem Perspective and Recovery

The List of Injured Resources consists mainly of single species and resources, but, as noted above, it provides a basis for evaluating the recovery of the overall ecosystem, its functions, and the services that it provides to people. In fact, through the *Restoration Plan*, the Trustee Council adopted an ecological approach to restoration, and the studies and projects the Trustee Council sponsors have been ecological in character.

Page 35 of the *Restoration Plan* defines ecosystem recovery as follows:

> *Full ecological recovery will have been achieved when the population of flora and fauna are again present at former or prespill abundances, healthy and productive, and there is a full complement of age classes at the level that would have been present had the spill not*

occurred. A recovered ecosystem provides the same functions and services as would have been provided had the spill not occurred.

Using this definition, the coastal and marine ecosystem in the oil spill region has not fully recovered at this time from the effects of the oil spill. For example, harlequin ducks and sea otters still show signs of oil exposure and may be negatively affected by such exposure. Although full ecological recovery has not been achieved, the spill area ecosystem is still largely intact and functioning and on its way to recovery 13 years after the *Exxon Valdez* oil spill.

It is desirable to have injured resources obtain a state that would have occurred in the absence of the spill. However, it also is important to understand that ecosystems are dynamic and would have changed even in the absence of the oil spill. Given our present ability to predict multi-year changes in marine ecosystems—which is extremely limited—it is very difficult to know how the ecosystem would have changed in the absence of the spill. For that reason, it is also sometimes necessary to consider other measures (return to prespill status or attaining equivalent status in oiled and unoiled areas) in order to have more concrete objectives. Also, as mentioned above, baseline data describing fish and wildlife populations, to say nothing of complex intertidal and subtidal communities, were generally poor in 1989. Therefore, in revising this list judgements have been made in the face of increasing knowledge—but also, great uncertainty—of how natural changes have occurred in the northern Gulf of Alaska.

RESOURCES

ARCHAEOLOGICAL RESOURCES

Injury

The oil spill area is believed to contain more than 3,000 sites of archaeological and historical significance. Twenty-four archaeological sites on public lands are known to have been adversely affected by cleanup activities or looting and vandalism linked to the oil spill. Additional sites on both public and private lands were probably injured, but damage assessment studies were limited to public land and not designed to identify all such sites.

Documented injuries included theft of surface artifacts, masking of subtle clues used to identify and classify sites, violation of ancient burial sites, and destruction of evidence in layered sediments. In addition, residual oil may have contaminated sites.

Recovery Objective

Archaeological resources are nonrenewable: they cannot recover in the same sense as biological resources. Archaeological resources will be considered to have recovered when spill-related injury ends, looting and vandalism are at or below prespill levels, and the

artifacts and scientific data remaining in vandalized sites are preserved (e.g., through excavation, site stabilization, or other forms of documentation).

Recovery Status

Assessments of 14 sites in 1993 suggested that most of the archaeological vandalism that can be linked to the spill occurred early in 1989, before adequate constraints were put into place over the activities of oil spill cleanup personnel. Most vandalism took the form of "prospecting" for high yield sites. Once these problems were recognized, protective measures were implemented and successfully limited additional injury. Although some cases of vandalism were documented in the 1990s, there appears to be no spill-related vandalism at the present time.

From 1994-1997, two sites in Prince William Sound were partly documented, excavated, and stabilized by professional archaeologists because they had been so badly damaged by oiling and erosion. The presence of oil in sediment samples taken from four sites in 1995 did not appear to have been the result of re-oiling by *Exxon Valdez* oil. Residual oil does not appear to be contaminating any known archaeological sites.

In 1993, the Trustee Council provided part of the construction costs for the Alutiiq Archaeological Repository in Kodiak. This facility now houses Kodiak area artifacts that were collected during spill response. In 1999, the Trustee Council approved funding for an archaeological repository and local display facilities for artifacts from Prince William Sound and lower Cook Inlet. These are currently in various stages of contruction.

Based on the apparent absence or extremely low rate of spill-related vandalism and the preservation of artifacts and scientific data on archaeological sites and artifacts, archaeological resources are considered to be recovered.

BALD EAGLES

Injury

The bald eagle is an abundant resident of marine and riverine shoreline throughout the oil spill area. Following the oil spill, a total of 151 eagle carcasses was recovered from the spill area. Prince William Sound provides year-round and seasonal habitat for about 6,000 bald eagles, and within the sound it is estimated that about 250 bald eagles died as a result of the spill. There were no estimates of mortality outside the sound, but there were deaths throughout the spill area. In addition to direct mortalities, productivity was reduced in oiled areas of Prince William Sound in 1989.

Recovery Objective

Bald eagles will have recovered when their population and productivity have returned to prespill levels.

Recovery Status

Productivity was back to normal in 1990 and 1991, and an aerial survey of adults in 1995 indicated that the population had returned to or exceeded its prespill level in the sound. **In September 1996, the Trustee Council classified the bald eagle as recovered from the effects of the oil spill.**

BLACK OYSTERCATCHERS

Injury

Black oystercatchers spend their entire lives in or near intertidal habitats and are highly vulnerable to oil pollution. It is estimated that 1,500-2,000 oystercatchers breed in south-central Alaska. Only nine carcasses of adult oystercatchers were recovered following the spill, but the actual number of mortalities may have been several times higher.

In addition to direct mortalities, breeding activities were disrupted by the oil and cleanup activities. When comparing 1989 with 1991, significantly fewer pairs occupied and maintained nests on oiled Green Island, while during the same two years the number of pairs and nests remained similar on unoiled Montague Island. Nest success on Green Island was significantly lower in 1989 than in 1991, but Green Island nest success in 1989 was not lower than on Montague Island. In 1989, chicks disappeared from nests at a significantly greater rate on Green Island than from nests on Montague Island. Disturbance associated with cleanup operations also reduced productivity on Green Island in 1990. In general, the overt effects of the spill and cleanup had dissipated by 1991, and in that year productivity on Green Island exceeded that on Montague Island.

Recovery Objective

Black oystercatchers will have recovered when the population returns to prespill levels and reproduction is within normal bounds. An increasing population trend and comparable hatching success and growth rates of chicks in oiled and unoiled areas, after taking into account geographic differences, will indicate that recovery is underway.

Recovery Status

Boat-based surveys of marine birds in Prince William Sound indicate that there are increases in numbers of oystercatchers in both the oiled and unoiled areas through 2000 (Stephenson et al., 2001). Given the fact that only 9 carcasses of this species were recovered in 1989 after the spill, it is likely that the population of the sound is probably as large or larger than previous to the spill.

In 1998 the Trustee Council sponsored a study to reassess the status of this species in Prince William Sound. The data indicated that oystercatchers have fully reoccupied and are nesting

at oiled sites in the sound. The breeding phenology of nesting birds was relatively synchronous in oiled and unoiled areas, and no oil-related differences in clutch size, egg volume, or chick growth rates were detected. A high rate of nest failures on Green Island probably can be attributed to predation, not lingering effects of oil. **Given general agreement between these results and those of the earlier work, which indicated that the effects of the spill on black oystercatchers had largely dissipated by 1991, black oystercatchers are considered to be recovered from the oil spill.**

CLAMS

Injury

The magnitude of immediate impacts on clam populations varied with the species of clam, degree of oiling, and location. Some littleneck clams and some butter clams were probably killed and may have suffered slower growth rates as a result of the oil spill and cleanup activities.

Recovery Objective

Clams will have recovered when populations and productivity have returned to levels that would have prevailed in the absence of the oil spill, based on comparisons of oiled and unoiled sites.

Recovery Status

Studies by the NOAA Hazardous Materials Division and others have been conducted on intertidal and subtidal communities in relation to oiling and shoreline treatments. In general, these studies indicated that intertidal fauna dwelling in soft sediments, including various clam species, had recovered to some extent within one to three years after 1989 on oiled-but-untreated shorelines. As of 1997, full recovery had not been achieved, especially on shorelines that were oiled and treated by hot-water washes. One study found that densities of littleneck and butter clams were depressed through 1997 on oiled, treated mixed-sedimentary shores where fine sediments had been washed downslope during pressured water treatments.

Comparing oiled study sites on Knight Island with unoiled sites on Montague Island, researchers in the Nearshore Vertebrate Predator Project found a full range of size classes of clams at the oiled sites, as well as more large clams. However, oiled sites also had fewer juvenile clams and lower numbers of several species. **Based on all of the evidence summarized above, clams are recovering, but are not yet fully recovered from the effects of the oil spill.** The Trustee Council is sponsoring a study of clam populations in FY02 to determine if the populations of clams on treated beaches have improved since 1997.

COMMON LOONS

Injury

Carcasses of 395 loons of four species were recovered following the spill, including at least 216 common loons. Current population sizes in the spill area are not known for any of these species. Common loons in the spill area may number only a few thousand, including only hundreds in Prince William Sound. Common loons injured by the spill probably included a mixture of wintering and migrating birds. The specific breeding areas used by the loons affected by the spill are not known.

Recovery Objective

Common loons will have recovered when their population returns to prespill levels in the oil spill area. An increasing population trend in Prince William Sound will indicate that recovery is underway.

Recovery Status

Boat-based surveys of marine birds in Prince William Sound give at least some insight into the recovery status of the loons affected by the oil spill. Prespill counts of loons exist only for 1972-1973 and 1984-1985. After the spill, contrasts between oiled and unoiled areas of the sound indicate that loons as a group are generally doing better in unoiled areas than in oiled areas. Thus, the survey data suggest that the oil spill had a negative effect on numbers of loons (all species combined) in the oiled parts of the sound. It is not known what the populations of loons may have been had the spill not occurred.

Based on the surveys carried out through 2000, there are indications of recovery, but only in 2000. In 2000 the highest counts ever recorded for common loons occurred in March surveys of Prince William Sound; however, these counts likely included some early migrants as well as wintering birds. In addition, July counts in 2000 were the third highest of the 11 years since 1972 with data. These increases were limited to the unoiled portion of the sound. Since loons are a highly mobile species with widely variable population numbers and the prespill data were limited, one year of high counts in the unoiled areas is insufficient to indicate that recovery has started. **Thus the common loon is considered still not to have recovered from the effects of the spill.**

COMMON MURRES

Injury

About 30,000 carcasses of oiled birds were picked up in the first four months following the oil spill, and 74 percent of them were common and thick-billed murres (mostly common murres). Many more murres probably died than actually were recovered. Based on surveys of index breeding colonies at such locations as the Barren Islands, Chiswell Islands, Triplet Islands, Puale Bay, and Ugiaushak Island, the spill area population may have declined by about 40 percent following the spill. In addition to direct losses of murres, there is evidence that the timing of reproduction was disrupted and productivity reduced. Interpretation of the effects of the spill, however, is complicated by incomplete prespill data and by indications that populations at some colonies were in decline before the oil spill.

Recovery Objective

Common murres will have recovered when populations at index colonies have returned to prespill levels and when productivity is sustained within normal bounds. Increasing population trends at index colonies will be indication that recovery is underway.

Recovery Status

Postspill monitoring at the breeding colonies in the Barren Islands indicated that reproductive success was within normal bounds by 1993, and it has stayed within these bounds each breeding season since then. During the period 1993-1997, the murres nested progressively earlier by 2-5 days each year, suggesting that the age and experience of nesting birds were increasing, as might be expected after a mass mortality event. By 1997, numbers of murres at the Barren Islands had increased, probably because 3-and 4-year old nonbreeding subadult birds that were hatched there in 1993 and 1994 were returning to their natal nesting colony. **Although there were low counts in 1996, the counts in 1997 through 1999 at this index site bring the colony sizes to prespill levels. That, coupled with normal productivity, indicate that recovery has been achieved for common murres.**

CORMORANTS

Injury

Cormorants are large fish-eating birds that spend much of their time on the water or perched on rocks near the water. Three species typically are found within the oil spill area. Carcasses of 838 cormorants were recovered following the oil spill, including 418 pelagic, 161 red-faced, 38 double-crested, and 221 unidentified cormorants. Many more cormorants probably died as a result of the spill, but their carcasses were not found. No regional population estimates are available for any of the cormorant species found in the oil spill area. In 1996, the U.S. Fish and Wildlife Service Alaska Seabird Colony Catalog, however, listed counts of 7,161 pelagic cormorants, 8,967 red-faced cormorants, and 1,558 double-crested cormorants in the oil spill area. These are direct counts at colonies, not overall population estimates, but they suggest that population sizes are small. In this context, it appears that injury to all three cormorant species was significant.

Counts on the outer Kenai Peninsula coast suggested that the direct mortality of cormorants due to oil resulted in fewer birds in this area in 1989 compared to 1986. In addition, there were statistically-significant declines in the estimated numbers of cormorants (all three species combined) in the oiled portion of Prince William Sound based on pre- and postspill boat surveys in July 1984-85 compared to 1989-91. It is not known what the counts and trends of comorants would have been in the absence of the oil spill.

Recovery Objective

Pelagic, red-faced, and double-crested cormorants will have recovered when they show an increasing population trend in Prince William Sound.

Recovery Status

More recent surveys (through 2000) have not shown a significant increasing population trend since the oil spill, and for that reason **these species are considered to be not recovering.**

CUTTHROAT TROUT

Injury

Prince William Sound is at the northwestern limit of the range of cutthroat trout. Local cutthroat trout populations are believed to be small, and the fish have small home ranges and are geographically isolated. Cutthroat trout, therefore, are highly vulnerable to exploitation, habitat alteration, or pollution. Following the oil spill, cutthroat trout in a small number of oiled index streams in Prince William Sound grew more slowly than in unoiled streams.

Recovery Objective

Cutthroat trout will have recovered when growth rates within oiled areas are similar to those for unoiled areas, after taking into account geographic differences.

Recovery Status

The apparent difference in growth rates between trout in oiled versus unoiled streams persisted through 1991. It was hypothesized that the slower rate of growth in oiled streams was the result of reduced food supplies or exposure to oil, and there was concern that reduced growth rates would result in reduced survival. However, preliminary data from a Trustee Council sponsored study of resident and anadromous forms of cutthroat trout in Prince William Sound suggest that there is significant genetic variation among trout from different locations across the sound. These data are consistent with the idea that cutthroat populations are small and isolated and effects other than oil could be causing the differences seen in the growth rates. The report on this work has experienced significant delays, but is near completion. **Pending the completion and review of this additional work, the recovery status of the cutthroat trout remains unknown.**

Designated Wilderness Areas

Injury

The oil spill delivered oil in varying quantities to the waters and tidelands adjoining eight areas designated as wilderness areas and wilderness study areas by Congress or the Alaska State Legislature. Oil also was deposited above the mean high-tide line at these locations. During the intense cleanup seasons of 1989 and 1990, thousands of workers and hundreds of pieces of equipment were at work in the spill zone. This activity was an unprecedented imposition of people, noise, and activity on the area's undeveloped and normally sparsely occupied landscape. Although activity levels on these wilderness shores have returned to normal, at some locations there is still residual oil.

Recovery Objective

Designated wilderness areas will have recovered when oil is no longer encountered in them and the public perceives them to be recovered from the spill.

Recovery Status

Among the affected areas were designated wilderness in the Katmai National Park, wilderness study areas in the Chugach National Forest and Kenai Fjords National Park, and Kachemak Bay Wilderness State Park. Six moderately to heavily oiled sites on the Kenai and Katmai coasts were last surveyed in 1994, at which time some oil mousse persisted in a remarkably unweathered state on boulder-armored beaches at five sites. These sites were visited again in 1999. The data from these sites indicate that there is still oil along park shorelines on the Katmai coast. Surveys carried out in 2001 to determine the surface and subsurface distribution of oil in Prince William Sound found significant quantities of oil on shorelines within designated wilderness study areas. The amount of oil in Prince William Sound has probably decreased since the early 1990s, and natural processes will lead to further reductions. **Therefore, designated wilderness is recovering but has not recovered from the oil spill.**

Dolly Varden

Injury

Dolly Varden are widely distributed in the spill area. In spring, anadromous forms of Dolly Varden migrate to the sea from the lakes and rivers where they spend the winter. Summers are spent feeding in nearshore marine waters. Thus, some Dolly Varden in Prince William Sound and perhaps at other locations were exposed to *Exxon Valdez* oil in 1989 and possibly beyond. In fact, concentrations of hydrocarbons in the bile of Dolly Varden were some of the highest of any fish sampled in 1989. Like the cutthroat trout, there is evidence from

1989-90 that Dolly Varden in a small number of oiled index streams in Prince William Sound grew more slowly than in unoiled streams. It was hypothesized that the slower rate of growth in oiled streams was the result of reduced food supplies or exposure to oil, and there was concern that reduced growth rates would result in reduced survival.

Recovery Objective

Dolly Varden will have recovered when growth rates within oiled streams are comparable to those in unoiled streams, after taking into account geographic differences.

Recovery Status

The growth differences between Dolly Varden in oiled and unoiled streams did not persist into the 1990-91 winter. No growth data have been gathered since 1991. In addition, by 1990 the concentrations of hydrocarbons in bile had dropped substantially.

In a 1991 restoration study sponsored by the Trustee Council, some tagged Dolly Varden moved considerable distances among streams within Prince William Sound, suggesting that mixing of overwintering stocks takes place during the summer in saltwater. This hypothesis is supported by preliminary data from another Trustee Council sponsored study, which indicates that Dolly Varden from different locations across the sound are genetically similar. The final report on this genetics study has been delayed, but should be completed soon. If this preliminary conclusion is born out, it would suggest that the Dolly Varden population in the sound should have little difficulty in recovering from any initial growth-related effects. **Pending completion of the genetics work and absent additional growth data, however, it is prudent to continue classifying the Dolly Varden as recovery unknown.**

HARBOR SEALS

Injury

Harbor seal numbers were declining in the Gulf of Alaska, including in Prince William Sound, before the oil spill. *Exxon Valdez* oil affected harbor seal habitats, including key haul-out areas and adjacent waters, in Prince William Sound and as far away as Tugidak Island, near Kodiak. Estimated mortality as a direct result of the oil spill was about 300 seals in oiled parts of Prince William Sound. Based on aerial surveys conducted at trend-count haulout sites in central Prince William Sound before (1988) and after (1989) the oil spill, seals in oiled areas declined by 43 percent, compared to 11 percent in unoiled areas.

Recovery Objective

Harbor seals will have recovered from the effects of the oil spill when their population is stable or increasing.

Recovery Status

In a declining population deaths exceed births, and harbor seals in both oiled and unoiled parts of Prince William Sound have continued to decline since the spill. It is not known what harbor seal populations would have been had the spill not occurred. For the period 1989-1997, the average estimated annual rate of decline was about 4.6 percent. **The population showed some signs of stabilizing in the 1990s, but surveys in 2000 and 2001 indicate that the decline is continuing. Therefore, harbor seals continue to be considered not recovering from effects of the oil spill.**

Environmental changes in the late 1970s may have reduced the amount or quality of prey resources, including such forage fishes as Pacific herring and capelin, available to harbor seals in the northern Gulf of Alaska ecosystem. These changes may have been responsible for or contributed to the initial prespill harbor seal decline, and the ecosystem may now support fewer seals than it did prior to the late 1970s. Recent studies, however, indicate that the seals in the sound, especially pups and yearlings, are in very good condition and do not show evidence of nutritional stress. Ongoing sources of mortality include killer whale predation, possible shark predation, subsistence hunting, and commercial fishery interactions (e.g., drowning in nets).

Satellite tagging studies sponsored by the Trustee Council and genetic studies carried out by the National Marine Fisheries Service indicate that harbor seals in the sound are largely resident throughout the year and have limited movement and interbreeding with other subpopulations in the northern Gulf of Alaska. This suggests that recovery must come largely through recruitment and survival within resident populations.

HARLEQUIN DUCKS

Injury

Harlequin ducks feed in intertidal and shallow subtidal habitats where most of the spilled oil was initially stranded. More than 200 harlequin ducks were found dead in 1989, mostly in Prince William Sound. Many more than that number probably died in the sound and perhaps thousands throughout the spill area. Because the spill occurred in early spring before wintering harlequins migrated from the sound to inland breeding sites, the initial effects of the spill likely affected harlequin duck productivity beyond the immediate spill zone. The geographic extent and magnitude of these extended impacts are not known.

Prespill data on harlequin populations and reproductive success are limited and difficult to interpret, but after the spill there was concern about poor reproductive success in the western versus eastern parts of Prince William Sound. This concern was based on observations of 7-15 broods in the eastern sound and few-to-no reports of broods in the western sound when comparable numbers of streams were surveyed.

Recovery Objective

Harlequin ducks will have recovered when hydrocarbon exposure is similar between oiled and unoiled areas; when numbers are stable or increasing; and when demographic attributes are similar and densities return to prespill levels.

Recovery Status

The current overwintering population of harlequin ducks in Prince William Sound is on the order of 18,000 ducks, while the summer population is about half that number. Surveys designed specifically to count harlequin ducks have been carried out in the fall, winter and spring in various years since the spill. Fall boat surveys to monitor molting-wintering harlequin ducks indicate a significant declining trend in the oiled western sound from 1995-1997, but no trend in the unoiled eastern sound. The spring harlequin duck surveys have only two years of data (1999 and 2000)—too little on which to draw conclusions, but increases in all areas of the sound in 2000 are promising. Spring surveys were also conducted in 2001 and 2002, but the results are not yet published. Other boat surveys designed to monitor an entire suite of marine birds in the sound have shown mixed results: an increasing trend in March surveys in unoiled areas, no trend in oiled areas between 1997 and 2000, and an increasing trend in both oiled and unoiled areas in July of these same years.

Postspill research does not indicate any differences in the age- and sex-structure of harlequin populations in the eastern and western parts of the sound, but it is clear that the breeding habitat in the western sound is very limited compared to what is available in the eastern sound. Some harlequins remain in the sound to nest in the spring and summer, mostly on the eastern side, but it is now suspected that most harlequins of breeding age and condition probably leave the sound altogether to nest in inland drainages. Thus, conclusions of reproductive failure based on lack of broods in the oiled area do not now seem warranted.

Oil remained in the subsurface of the intertidal zone through 2001, including under some mussel beds where harlequin ducks could be feeding. Biopsies from harlequin and Barrow's goldeneye ducks continue to show differences in an enzyme indicative of exposure to hydrocarbons between birds from oiled versus unoiled parts of the sound. These differences are consistent with the possibility of continued exposure to spill-derived hydrocarbons in the western sound. The biological effect of this possible exposure has not been established, but three years of data (1995-98 winters) on overwintering survival of adult female harlequins indicate significantly lower survival rates in oiled versus unoiled parts of the sound. This trend may be continuing. Although this result cannot be attributed unequivocally to oil exposure, there is reason for concern about possible oil exposure and reduced survival for harlequin ducks in the western sound.

Taken together, the population census trends, survival measures and indicators of exposure, suggest that the harlequin duck is recovering but has not recovered from the effects of the oil spill. Trustee Council sponsored studies give insight into prospects for recovery of harlequin ducks. Although some harlequin ducks make major seasonal movements, they exhibit high site fidelity to summer breeding sites and to molting and wintering sites during non-breeding seasons. Strong site fidelity may limit population recovery by immigration, but a genetic analysis of

harlequin ducks indicates that the spill area population is homogeneous (i.e., very similar throughout). Taken together, these data are consistent with a low rate of dispersal, perhaps at the subadult stage, or a rapid expansion of the population in recent geological time. To the extent that there is subadult dispersal from adjacent expanding populations, such dispersal would enhance recovery. It is likely, however, that recovery will largely depend on recruitment and survival from within injured populations. This recovery may be compromised if exposure to lingering hydrocarbons reduces fitness and survival of harlequin ducks.

INTERTIDAL COMMUNITIES

Injury

Portions of 1,400 miles of coastline were oiled by the spill in Prince William Sound, on the Kenai and Alaska peninsulas, and in the Kodiak Archipelago. Both the oil and intensive cleanup activities had significant impacts on the flora and fauna of the intertidal zone. Intertidal communities are intrinsically important and are resources for subsistence users, sea and river otters, and a variety of birds, including black oystercatchers, harlequin ducks, and pigeon guillemots.

Initial impacts to intertidal organisms occurred at all tidal levels and in all types of habitats throughout the oil spill area. Many species of algae and invertebrates were less abundant at oiled sites than at unoiled reference sites. Some, more opportunistic species, including a small species of barnacle, oligochaete worms, and filamentous brown algae, colonized shores affected by the oil spill and cleanup activities. The abundance and reproductive potential of the common seaweed, *Fucus gardneri* (known as rockweed or popweed), also was reduced following the spill.

Recovery Objective

Intertidal communities will have recovered when community composition on oiled shorelines is similar to that which would have prevailed in the absence of the spill. Indications of recovery are the reestablishment of important species, such as *Fucus*, at sheltered rocky sites, the convergence in community composition and organism abundance on oiled and unoiled shorelines, and the provision of adequate, uncontaminated food supplies for top predators in intertidal and nearshore habitats.

Recovery Status

In the lower and middle intertidal zones on oiled rocky shores, algal coverage and invertebrate abundances had returned by 1991 to coverages and abundances similar to those observed in unoiled areas. However, large fluctuations in the algal coverage have taken place in the oiled areas since the spill. This pattern is consistent with continued instability due to the original spill impact and the subsequent cleanup. However, instability of *Fucus*

populations during the last 12 years probably results from a combination of spill- and naturally-induced changes, with a greater influence of natural events in the later years.

On the sheltered, bedrock shores that are common in Prince William Sound, full recovery of *Fucus* is crucial for the recovery of intertidal communities at these sites, since many invertebrate organisms depend on the cover provided by this seaweed. As of 1997, *Fucus* had not yet fully recovered in the upper intertidal zone on shores subjected to direct sunlight, but in many locations, recovery of intertidal communities had been substantial. In other habitat types, such as estuaries and cobble beaches, many species did not show signs of recovery when they were last surveyed in 1991. In studies of the effects of cleanup activities on beaches, invertebrate molluscs and annelid worms on oiled and washed beaches were still much less abundant than on comparable unoiled beaches through 1997.

More recent data should soon be available, including results of a study in the summer of 2002 to determine if intertidal clam populations on oiled shorelines are comparable to those on unoiled shorelines. **Based on substantial progress, but the lack of full recovery of some soft-sediment intertidal invertebrates, as well as the continued presence of residual oil and the role of oil in initiating *Fucus* population instability, the intertidal communites are considered to be recovering.**

KILLER WHALES

Injury

More than 115 killer whales in eight "resident" pods regularly use Prince William Sound/Kenai Fjords as part of their ranges. Other whales in "transient" groups are observed in the sound less frequently. There has been particular concern about the resident AB pod, which numbered 36 animals prior to the spill. Fourteen whales disappeared from this pod in 1989 and 1990, and no young were recruited into the population. The original link between the AB pod losses and the oil spill was largely circumstantial, although the pod was observed surfacing in an *Exxon Valdez* oil slick following the spill in 1989. The rate of disappearance and likely mortality of killer whales in this well-studied pod far exceeded rates observed for other pods in British Columbia and Puget Sound over the last 30 years, and in the northern Gulf of Alaska over the last 18 years. Another possible cause for the disappearance of the whales in the AB pod was the possible shooting of killer whales due to conflicts with long-line fisheries prior to the oil spill. No long-line fisheries were carried out between the last count of this pod in 1988 and the spill in the spring of 1989, after which there were numerous missing whales. However, it is possible that the effects from the conflicts in the 1980s may still be apparent.

Recovery Objective

Killer whales in the AB pod will have recovered when the number of individuals in the pod is stable or increasing.

Killer whale researchers were concerned in the 1990s that the losses of key individuals in the AB pod in 1989 and 1990 would eventually lead to disintegration of the social structure of the AB pod and thus jeopardize its long term viability. For that reason, a modest recovery objective of a stable or increasing number of whales in AB pod was adopted in 1999.

Recovery Status

By 1993 the AB pod had increased to 26 individuals as births outpaced deaths. In 1995 mortalities, including animals orphaned in 1989-90, reduced the pod to 22 whales. Since 1995 the pod again has increased steadily in size to 26 individuals in 2001. Thus, social disintegration has not happened and an apparently stable structure has been achieved. Overall numbers within the major resident killer whale pods in Prince William Sound are at or exceed prespill levels, even though the AB pod—one of eight—may or may not regain its former size. While AB pod has not regained its prespill size of 36 individuals, **there has been sufficiently steady growth in the pod over the past six years so that there is confidence that the restoration objective of increasing or stable size has been met. Therefore the killer whales are considered to have recovered from the oil spill.**

In addition to the AB pod, there is concern that a decline in resightings of individuals within the AT1 group of transient killer whales has accelerated following the oil spill. Although there is no evidence linking the oil spill to the AT1 group, this update also reports on its status. Recent genetic analyses show that resident and transient killer whales in Prince William Sound are genetically distinct. Since 1990 and 1991, 11 individuals have been missing from the AT1 group and are now almost certainly dead. During that same period there has been no recruitment of calves into this pod of transients. Transient killer whales largely prey on marine mammals, and there has been a 60 percent decline in the harbor seal population in the sound over the last two decades. Changes in the availability of such an important prey species could influence killer whale distribution and reproduction. Trustee Council sponsored research on contaminants in killer whales in Prince William Sound indicates that some transient whales, including the AT1 group, are carrying high concentrations of PCBs, DDT, and DDT metabolites in their blubber. The presence of such contaminants is not related to the oil spill. The high concentrations of contaminants found in the transient whales are comparable to those found to cause reproductive problems in other marine mammals.

KITTLITZ'S MURRELETS

Injury

The Kittlitz's murrelet is found only in Alaska and portions of the Russian Far East. A large fraction of the world population, which may number only a few tens of thousands, breeds in Prince William Sound. The Kenai Peninsula coast and Kachemak Bay are also important concentration areas for this species. Very little is known about Kittlitz's murrelets, but they are known to associate closely with tidewater glaciers and nest on scree slopes and similar sites on the ground.

Seventy-two Kittlitz's murrelets were positively identified among the bird carcasses recovered after the oil spill. Nearly 450 more *Brachyramphus* murrelets were not identified to the species level, and it is reasonable to assume that some of these were Kittlitz's. In addition, many more murrelets probably were killed by the oil than were actually recovered. It is likely that about 500 individuals died as an acute effect of the oil spill, which would represent a substantial fraction of the world population.

Recovery Objective

No recovery objective can be identified for Kittlitz's murrelet at this time.

Recovery Status

Because so little is known about this species, the Trustee Council funded an exploratory study on the ecology and distribution of the Kittlitiz's murrelet in Prince William Sound starting in 1996. This project found that this species has an affinity for tidewater glaciers in the northern and northwestern parts of the sound. It also appears that reproductive output in 1996 and 1997 was extremely low or absent, and some Kittlitz's murrelets were apparently paired with marbled murrelets. There appear to be about 1,200-1,400 Kittlitz's murrelets during summer in the four bays studied in northern and northwestern sound. Another, more extensive marine bird boat survey conducted in 2001 suggests a sound-wide summer population of about 2,500 murrelets. These estimates are consistent with what is believed to be a small Alaska and world population.

The population data, indications of low reproductive success, and affinity to tidewater glaciers (of which the lower elevation glaciers are receding rapidly) are reasons for concern about the long-term conservation of Kittlitz's murrelets. **Specifically, with reference to the effects of the oil spill, however, the original extent of the injury and its recovery status are still unknown and may never be resolved. Therefore, this species is in the recovery unknown category.**

MARBLED MURRELETS

Injury

The northern Gulf of Alaska, including Prince William Sound, is a key area of concentration in the distribution of marbled murrelets. The marbled murrelet is federally listed as a threatened species in Washington, Oregon, and California; it also is listed as threatened in British Columbia. The marbled murrelet population in Prince William Sound had declined before the oil spill. The causes of the prespill decline are not known for certain, but environmental changes in the late 1970s probably reduced the availability or quality of prey resources. There is, nonetheless, clear evidence that oil caused injury to marbled murrelets in the sound. Carcasses of nearly 1,100 *Brachyramphus* murrelets were found after the spill, and about 90 percent of the murrelets that could be identified to the species level were

marbled murrelets. Many more murrelets probably were killed by the oil than were found, perhaps as much as 7 percent of the spill area population.

Recovery Objective

Marbled murrelets will have recovered when their populations are stable or increasing. Stable or increasing productivity will be an indication that recovery is underway.

Recovery Status

The recovery of the marbled murrelet population in Prince William Sound is assessed primarily through standard marine bird boat-based surveys. As a result of boat surveys carried out in July for seven years from 1989-2000, densities of marbled murrelets decreased in both the oiled and unoiled areas of Prince William Sound. However, for the March surveys carried out in most years between 1990 and 2000, there have been no significant trends in the population size, although the counts have increased in both oiled and unoiled areas. The reason for the summer time declines in both oiled and unoiled areas is probably due to some factor other than the oil spill. The Trustee Council's Alaska Predator Ecosystem Experiment (APEX) project has investigated the relationship between marbled murrelet declines and the availability and abundance of forage fish, such as Pacific herring, sand lance, and capelin. It appears that there is a direct correlation between the availability of forage fish and production of young murrelets, based on the presence of juvenile murrelets on the water in Prince William Sound.

The summer time marbled murrelet population is not stable nor increasing, but the March population is stable over time. Marbled murrelet productivity, as measured by surveys of adults and juveniles on the water in Prince William Sound, appears to be within normal bounds. **On these bases, it appears that the marbled murrelet is at least recovering from the effects of the oil spill, but clearly has not yet recovered.**

MUSSELS

Injury

Mussels are an important prey species in the nearshore ecosystem throughout the spill area and are locally important for subsistence. Beds of mussels provide physical stability and habitat for other organisms in the intertidal zone and were purposely left alone during *Exxon Valdez* cleanup operations. In 1991, high concentrations of relatively unweathered oil were found in the mussels and in underlying byssal mats and sediments in certain dense mussel beds. The biological significance of oiled mussel beds is not known precisely, but they are potential pathways of oil contamination for bird and mammal populations (e.g., harlequin ducks and sea otters) which include mussels and other prey in and around mussel beds in their diets.

Recovery Objective

Mussels will have recovered when concentrations of oil in the mussels reach background levels.

Recovery Status

The Trustee Council's Nearshore Vertebrate Predator project has found evidence of hydrocarbon exposure in sea otters, river otters, harlequin ducks, and Barrow's goldeneyes in oiled parts of Prince William Sound in 1996 and 1997. Again in 2000 both sea otters and harlequin ducks showed evidence of oil exposure, but the pathway of such exposure has not been established. Both of these species include mussels in their diets.

About 30 mussel beds in Prince William Sound still contained *Exxon Valdez* oil residue when last sampled in 1995. Twelve of these beds had been cleaned on an experimental basis in 1993 and 1994. In 1995, oil hydrocarbon concentrations in mussels at half the treated beds were lower than would have been expected if the beds had not been cleaned. In 1996, however, limited sampling indicated that several of the cleaned beds had been recontaminated from surrounding or underlying oil residue.

Mussel beds along the outer Kenai Peninsula coast, the Alaska Peninsula, and Kodiak Archipelago were surveyed for the presence of oil in 1992, 1993, and 1995. In 1995, hydrocarbon concentrations in mussels and sediments at these Gulf of Alaska sites were generally lower than for sites in Prince William Sound, but at some sites substantial concentrations persisted. While several sites in Prince William Sound still contained high concentrations of oil in 1995, over half the sites surveyed demonstrated significant natural declines that suggest background concentrations should be reached in the next few years. Oil contamination in mussels, however, will likely persist for many years at certain sites that are well protected from wave action or where oil penetrated deeply into underlying sediments.

The latest available data, taken in 1999, indicates that oil is still being accumulated in mussels, but more data will be available soon on samples taken in the summer of 2001. Since the latest available data indicates that oil remains in mussels, they are considered to be recovering from the oil spill, but not yet recovered.

PACIFIC HERRING

Injury

Pacific herring spawned in intertidal and subtidal habitats in Prince William Sound shortly after the oil spill. A significant portion of these spawning habitats, as well as herring staging areas in the sound, were contaminated by oil. Field studies conducted in 1989 and 1990 documented increased rates of egg mortality and larval deformities in oiled versus unoiled areas. Subsequent laboratory studies confirm that these effects can be caused by exposure to *Exxon Valdez* oil, but the significance of these injuries at a population level is not known.

The 1988 prespill year-class of Pacific herring was very strong in Prince William Sound, and, as a result, the estimated peak biomass of spawning adults in 1992 was very high. Despite the large spawning biomass in 1992, the population exhibited a density-dependent reduction in size of individuals, and in 1993 there was an unprecedented crash of the adult herring population. A viral disease and fungus may have been the immediate agents of mortality or a consequence of other stresses, such as a reduced food supply and increased competition for food.

Recovery Objective

Pacific herring will have recovered when the next highly successful year class is recruited into the spawning population and when other indicators of population health are sustained within normal bounds in Prince William Sound.

Recovery Status

Laboratory investigations since the 1993 population crash have shown that exposure to very low concentrations of *Exxon Valdez* oil can compromise the immune systems of adult herring and lead to expression of the viral disease. The extent to which the exposure to oil contributed to the 1993 disease outbreak is uncertain. There is also evidence that plankton production in the 1990s was less than in the 1980s, and so food limitation at the time of a peaking population may have contributed to the 1993 population crash.

Numbers of spawning herring in Prince William Sound remained depressed through the 1995 season. In 1997 and 1998 the spawning biomass was about double that of 1994, the season following the crash, and there were limited commercial harvests for herring in the sound. The increased biomasses in 1997 and 1998 were signs that recovery had begun. Unfortunately, in the last several years the recovery has stalled and the population has yet to recruit a highly successful year-class, which is fundamental to recovery of this species. There is evidence from limited collections in the spring of 2002 that a large proportion of the Pacific herring population in Prince William Sound is now composed of young, 3-year old fish. If this preliminary trend holds up, it is possible that the next large year class has moved into the population signaling the continuation of recovery. **Based on this information, the Pacific herring can only be considered to be recovering.**

The Trustee Council's Sound Ecosystem Assessment has resulted in new understanding of the importance of body condition in determining overwintering survival of herring and in the influences of the Gulf of Alaska on herring productivity within Prince William Sound. Ongoing research on herring disease in relation to commercial fishing practices, such as the enclosed "pound" fisheries, have direct implications for management of the herring fishery.

PIGEON GUILLEMOTS

Injury

Although pigeon guillemots are widely distributed in the north Pacific region, they do not occur anywhere in large concentrations. Because guillemots feed in shallow, nearshore waters, guillemots and the fish and invertebrates on which they prey are vulnerable to oil pollution. Like the marbled murrelet, there is evidence that the pigeon guillemot population in Prince William Sound declined before the oil spill. The causes of the prespill decline are not known for certain, but environmental changes in the late 1970s probably reduced the availability or quality of prey resources. There is, nonetheless, clear evidence that oil caused injury to the guillemot population in the sound. An estimated 10-15 percent of the spill area population died immediately following the spill. Boat-based surveys of marine birds before (1984-85) and after the oil spill indicated that the guillemot population declined throughout the oiled portion of the sound. It is not known what pigeon guillemot populations would be had the oil spill not occurred.

Recovery Objective

Pigeon guillemots will have recovered when their population is stable or increasing. Sustained productivity within normal bounds will be an indication that recovery is underway.

Recovery Status

Boat surveys have indicated that numbers of guillemots in the summer time remained depressed along both oiled and unoiled shorelines in the Prince William Sound through 2000. March surveys reveal no significant trends in abundance although the data appear to suggest a decline at this time of year as well. **For these reasons the pigeon guillemot is still considered to be not recovering from the effects of the oil spill.**

The Trustee Council's Alaska Predator Ecosystem Experiment (APEX) has investigated the possible link between pigeon guillemot declines and the availability of high-quality forage fish, such as Pacific herring and sand lance. This work has revealed a strong connection between the availability of certain prey fishes, especially sand lance, and guillemot chick growth rates, fledging weights, and nesting population size. The APEX project and the Nearshore Vertebrate Predator (NVP) project, also sponsored by the Trustee Council, addressed the possibility that exposure to oil is limiting the guillemot's recovery. The biochemical data indicated that adult guillemots were experiencing greater hydrocarbon exposures in western Prince William Sound than in the eastern portion of the sound as recently as 1999. However, guillemot chicks, which are restricted to the nest and are fed only fish, are not being exposed to hydrocarbons.

PINK SALMON

Injury

Certain features of the life history of pink salmon made this species highly vulnerable to damage from the oil spill. As much as 75 percent of wild pink salmon in Prince William Sound spawn in the intertidal portions of streams, where embryos deposited in the gravel were chronically exposed to hydrocarbon contamination in the water column or leaching from oil deposits on adjacent beaches. When juvenile pink salmon migrate to saltwater, they spend several weeks foraging for food in nearshore habitats. Thus, juvenile salmon entering seawater from both wild and hatchery sources could have been exposed to oil as they swam through oiled waters and fed along oiled beaches. Trustee Council sponsored studies have documented two primary types of injury due to the exposure of these early life stages: 1) growth rates in both wild and hatchery-reared juvenile pink salmon from oiled parts of the sound were reduced; and 2) there was increased egg mortality in oiled versus unoiled streams.

Recovery Objective

The Trustee Council's recovery objective in 1999 required a sequence of two years each of odd- and even-year runs without differences in egg mortality. This data is no longer gathered by the Alaska Department of Fish and Game because the expense of replicating the entire study for another four years, without being able to account for other factors, did not make it worth continuing. Therefore, a more realistic recovery objective is used based on hydrocarbon exposure of embryos since this is the major pathway of pink salmon exposure. Pink salmon will have recovered when ongoing oil exposure is negligible.

Recovery Status

In the years preceding the spill, returns of wild pink salmon in Prince William Sound varied from a maximum of 23.5 million fish in 1984 to a minimum of 2.1 million in 1988. Since the spill, returns of wild pinks have varied from a high of about 12.7 million fish in 1990 to a low of about 1.9 million in 1992. In 2001 the return of wild stock fish was estimated to be 6.7 million fish. The decade preceding the oil spill was a time of very high productivity for pink salmon in the sound, and, given the tremendous natural variation in adult returns, it is impractical to measure directly the extent to which wild salmon returns since 1989 were influenced by the oil spill. Based on intensive studies and mathematical models carried out following the spill, wild adult pink salmon returns to the sound's Southwest District in 1991 and 1992 were most likely reduced by a total of 11 percent. However, such an approach is unlikely to produce reliable multi-generational injury estimates. In addition, an analysis of escapement data from 1968-2001 showed no apparent time trends in annual escapements in either the oiled or unoiled parts of the sound. Therefore, there appear to be no observable effect at the population level at this time.

Reduced juvenile growth rates in Prince William Sound occurred only in the 1989 season, but higher egg mortality persisted in oiled compared to unoiled streams through 1993. No

statistically significant differences in egg mortalities in oiled and unoiled streams were detected in 1994 through 1996, but in 1997 there was again a difference. It is not clear whether the 1997 difference was due to the effects of lingering weathered oil, perhaps newly exposed by storm-related disturbance of adjacent beaches, or due to other natural factors such as differences in the physical environment. Patches of weathered oil still persist in or near intertidal spawning habitats in a few of the streams used by pink salmon in southwestern Prince William Sound. In 1999 dissolved oil measurements were made in six of the most affected streams in the oil spill area. Methods were used that were extremely sensitive. Only one of the six streams had clearly measurable concentrations of oil. The one measurable concentration was about a thousand times lower than the concentration established through Trustee Council sponsored studies to be toxic to developing pink salmon embryos. Therefore, the biological impact of exposure of pink salmon embryos to lingering oil is negligible and is therefore unlikely to limit pink salmon populations. Recent measurements of hydrocarbons in other intertidal areas located near known subsurface oil deposits showed much higher concentrations of oil in the water, but were not located near salmon streams. **It is highly unlikely that oil is now accumulating in pink salmon embryos and having any significant effects. Therefore, the pink salmon are considered recovered from the effects of the oil spill.**

Throughout Alaska there is increasing recognition of the importance of changes in marine ecosystems on the growth and survival of salmon. The Sound Ecosystem Assessment (SEA) project explored oceanographic and ecological factors that influence production of pink salmon and Pacific herring in Prince William Sound. These factors include such things as the timing of spring plankton blooms and changes in circulation patterns that link the sound to the Gulf of Alaska, and are likely to have the greatest influence on year-to-year returns in both wild and hatchery stocks of pink salmon.

River Otters

Injury

River otters have a low population density in Prince William Sound. Twelve river otter carcasses were found following the spill, but the actual total mortality is not known. Studies conducted during 1989-91 identified several differences between river otters in oiled and unoiled areas in Prince William Sound, including biochemical alterations, reduced diversity in prey species, reduced body size (length-weight), and increased home-range size. Because there were few prespill data, it is not certain that these differences are the result of the oil spill.

Recovery Objective

The river otter will have recovered when biochemical indices of hydrocarbon exposure or other stresses and indices of habitat use are similar between oiled and unoiled areas of Prince William Sound, after taking into account any geographic differences.

Recovery Status

Although some of the differences (e.g., values of blood characteristics) between river otters in oiled and unoiled areas in Prince William Sound persisted through 1996, there were few differences documented in 1997 and 1998. **Thus, there are no indications of possible lingering injury from the oil spill, and the Trustee Council's recovery objective has been met. River otters are considered to be recovered.**

ROCKFISH

Injury

Very little is known about rockfish populations (of several species) in the northern Gulf of Alaska. A small number of dead adult rockfish was recovered following the oil spill, and autopsies of five specimens indicated that oil ingestion was the cause of death. Analysis of other rockfish showed exposure to hydrocarbons and probable sublethal effects. In addition, closures to salmon fisheries apparently had the effect of increasing fishing pressure on rockfish, which, in turn, may have adversely affected local rockfish populations.

Recovery Objective

No recovery objective can be identified.

Recovery Status

The original extent of injury and the current recovery status of this species are unknown. Because little is known about rockfish abundance and species composition in the spill area and because rockfish are harvested commercially, even basic information about these species could provide a basis for improved management or, at least, the identification of priorities for more targeted research. Accordingly, starting in FY 1998, the Trustee Council sponsored a multi-year study of genetic stock structure in black, dusky, and yelloweye rockfish throughout the spill area and the adjacent Gulf of Alaska. The Alaska Department of Fish and Game study was not completed by the principal investigator.

SEA OTTERS

Injury

By the late 1800s, sea otters had been eliminated from most of their historical range in Alaska due to excessive harvesting by Russian and American fur traders. Surveys of sea otters in the 1970s and 1980s, however, indicated a healthy and expanding population in most of Alaska, including Prince William Sound. Today the only harvests of sea otters are for subsistence purposes. About 1,000 sea otter carcasses were recovered following the spill,

and additional animals probably died but were not recovered. In 1990 and 1991, higher-than-expected proportions of prime-age adult sea otters were found dead in western Prince William Sound, and there was evidence of higher mortality of recently weaned juveniles in oiled areas.

Recovery Objective

Sea otters will have recovered when the population in oiled areas returns to its prespill abundance and distribution. An increasing population trend and normal reproduction and age structure in western Prince William Sound will indicate that recovery is underway.

Recovery Status

By 1992-93, overwintering mortality rates for juveniles had decreased, but were still higher in oiled than in unoiled parts of the sound. Based on both aerial and boat surveys conducted in western Prince William Sound, there is statistically significant evidence of a population increase following the oil spill (1993-98). Observations by local residents bear out this general increase. However, within the most heavily oiled bays in the western sound, such as those on northern Knight Island, the aerial surveys indicate that recovery is not complete.

The Trustee Council's Nearshore Vertebrate Predator project addressed the lack of recovery in sea otters in these heavily oiled bays. The lack of recovery may reflect the extended time required for population growth for a long-lived mammal with a low reproductive rate, but it also could reflect the effects of continuing exposure to hydrocarbons, or a combination of both factors. Through 2000, researchers have continued to find biochemical evidence of oil exposure in sea otters around northern Knight Island. Biochemical samples from 2001 are now being analyzed. An additional hypothesis is that food supplies are limiting recovery, but the evidence does not fully support this idea.

It is clear that sea otter recovery is underway for much of the spill area, with the exception of populations at the most heavily oiled bays in western Prince William Sound. For this reason, sea otters continue to be in the recovering category.

SEDIMENTS

Injury

Exxon Valdez oil penetrated deeply into cobble and boulder beaches that are common on shorelines throughout the spill area, especially in sheltered habitats. Cleaning and natural degradation removed much of the oil from the intertidal zone, but visually identifiable surface and subsurface oil persists at many locations.

Recovery Objective

Sediments will have recovered when there are no longer residues of *Exxon Valdez* oil on shorelines (both intertidal and subtidal) in the oil spill area. Declining oil residues and diminishing toxicity are indications that recovery is underway.

Recovery Status

A comprehensive survey of shorelines in Prince William Sound was conducted in 1993, but that survey has been repeated in the summer of 2001 with revised methods for better quantifying the oil remaining in intertidal sediments. The 2001 surveys indicate that about 20 acres of continuously oiled intertidal habitat now persist in Prince William Sound. While it appears that natural weathering processes are gradually reducing the amount of remaining oil in sediments, the amount estimated in 2001 is about twice the amount estimated to be in the sediments in 1993 (using methods that were designed in 1989 more for cleanup decisions than for quantitative estimates of remaining oil). The shorelines of the outer Kenai and Alaska Peninsula coasts get more wave action than most shorelines within Prince William Sound. These Gulf of Alaska sites tended to be contaminated with oil in the form of mousse, a stable emulsion of oil in water, which can persist for long periods in a largely unweathered state. Five of six index beaches on the gulf coast have a heavy boulder "armor" and were last visited in 1993 and 1994. At that time, surface and subsurface oil mousse persisted in a remarkably unweathered state.

In 1995, a shoreline survey team visited 30 sites in the Kodiak Archipelago that had measurable or reported oiling in 1990 and 1991. The survey carried out in 1995 around Kodiak Island found no oil or only trace amounts, so oiling in the Kodiak area has not persisted as it has in the sound. Following the oil spill, chemical analyses of oil in subtidal sediments were conducted at a small number of index sites in Prince William Sound. At these sites, oil in subtidal sediments was mostly confined to the uppermost 20 meters water depths (below mean low tide), although elevated levels of hydrocarbon-degrading bacteria (associated with elevated hydrocarbons) were detected at depths of 40 and 100 meters in 1990 in Prince William Sound. By 1993 however, there was little evidence of *Exxon Valdez* oil and related elevated microbial activity at most index sites in Prince William Sound, except at those associated with sheltered beaches that were heavily oiled in 1989. These index sites—at Herring, Northwest, and Sleepy bays—are among the few sites at which substantial subsurface oiling is still known to occur.

Based on the information above, sediments are considered to be recovering. However, the presence of surface and subsurface oil continues to compromise wilderness and recreational values, expose and potentially harm living organisms, and offend visitors and residents, especially those who engage in subsistence activities along still-oiled shorelines.

SOCKEYE SALMON

Injury

Commercial salmon fishing was closed in Prince William Sound and in portions of Cook Inlet and near Kodiak in 1989 to avoid any possibility of contaminated salmon being sent to market. As a result, there were higher-than-desirable numbers (i.e., "overescapement") of spawning sockeye salmon entering the Kenai River and also Red and Akalura lakes on Kodiak Island. Research carried out following the spill demonstrated that initially these high escapements produced an overabundance of juvenile sockeye that then overgrazed the zooplankton, thus altering planktonic food webs in the nursery lakes. The result was lost sockeye production as shown by reduced growth rates during the freshwater part of the sockeye life history and declines in the returns of adults per spawning sockeye.

Recovery Objective

Sockeye salmon in the Kenai River system and Red and Akalura lakes will have recovered when adult returns per spawner are within normal bounds.

Recovery Status

Although sockeye freshwater growth tended to return to normal within two or three years following the overescapement, there are indications that these systems are less stable for several years after an initial overescapement event. The negative effects of the 1989 overescapement on sockeye productivity, as measured by return per spawner, in the Kenai River watershed were readily apparent for returns from the brood years 1989-92. Production of zooplankton in both Red and Akalura lakes on Kodiak Island has rebounded from the effects of the overescapement at the time of the oil spill. By 1997, Red Lake had responded favorably in terms of smolt and adult production and was at or near prespill production of adult sockeye. At Akalura Lake there were low juvenile growth rates in freshwater during the period 1989-92, and these years of low growth correspond to low adult escapements during the period 1994-97. Starting in 1993, however, the production of smolts per adult increased sharply and the smolt sizes and age composition suggested that rearing conditions have improved. There also was concern about overescapement effects in lakes on Afognak Island and on the Alaska Peninsula. However, analysis of sockeye freshwater growth rates of juveniles from Chignik Lake on the Alaska Peninsula did not identify any impacts associated with a 1989 overescapement event. On the basis of catch data through 2001 and in view of recent analyses of return per spawner estimates presented to the Alaska Board of Fisheries in 2001, the return per spawner in the Kenai River system is within historical bounds. **Therefore, it is highly unlikely that the effects that reverberated from the overescapements in 1989 continue to affect sockeye salmon (e.g., cause abnormal returns per spawner) and this species is considered to be recovered from the effects of the oil spill.**

SUBTIDAL COMMUNITIES

Injury

Shallow subtidal habitats of Prince William Sound, from the lower intertidal zone to depths of about 20 meters, typically have dense stands of kelp or eelgrass and contain numerous polychaete worms, snails, clams, sea urchins, and other invertebrate life. These subtidal communities provide shelter and food for an array of nearshore fishes, birds, and marine mammals. Oil that was transported down to subtidal habitats, as well as subsequent cleanup activities involving extensive vessel traffic, apparently caused changes in the abundance and species composition of plant and animal populations below lower tides.

Biologically, negative effects of the oil were most evident for oil-sensitive species of amphipods, which were consistently less abundant at oiled than at unoiled sites. Reduced numbers of eelgrass shoots and flowers may have been due to increased turbidity associated with cleanup activities (e.g., boat traffic). Two species of sea stars and helmet crabs also were less abundant at oiled sites. Some invertebrates living in the sediment, including species in eight families of polychaete worms, two families of snails, and one family of mussels, were greater in numbers at oiled sites. These species are more tolerant of oil exposure and may have also responded to the organic enrichment associated with oil. Some of the species that showed increased numbers also may have benefited from reduced competition or predation due to the effects of the spill. It is also is to be expected that when comparing any two sets of bays that measuring a large number of species will turn up differences just on the basis of chance.

Recovery Objective

Subtidal communities will have recovered when community composition in oiled areas, especially in association with eelgrass beds, is similar to that in unoiled areas or consistent with natural differences between sites such as proportions of mud and sand.

Recovery Status

Different habitats, emphasizing eelgrass beds and adjacent areas of soft sediment, were compared at oiled and unoiled sites from 1990-1995. It is difficult to draw firm conclusions from this study, because it is hard to distinguish between natural site differences (e.g., percent sand and mud) and those differences actually resulting from the oil spill or cleanup. Concentrations of hydrocarbons in subtidal sediments were significantly higher at oiled sites than at unoiled reference sites but never very high by comparison with concentrations known to cause community responses in the scientific literature. These oil concentrations dropped sharply by 1991, but evidence of oil contamination due to *Exxon Valdez* oil persisted at some locations through 1995 at very low concentrations. **By 1995, based on postspill comparisons of oiled and unoiled sites, there was recovery of most constituents of the eelgrass community.** In 1999 an article had been published in the peer reviewed literature that acknowledged the role that natural factors may be playing in the remaining differences in subtidal communities between oiled and unoiled bays. **Given that the remaining faunal**

differences could likely be due to the influence of natural factors and given that seven more years of additional natural recovery have occurred since the last study of subtidal fauna, the subtidal communities are judged to be recovered from the effects of the oil spill.

HUMAN SERVICES

COMMERCIAL FISHING

Injury

Commercial fishing is a service that was reduced through injury to commercial fish species (see individual resource accounts) and also through fishing closures. In 1989, closures affected fisheries in Prince William Sound, Cook Inlet, the outer Kenai coast, Kodiak, and Chignik. These closures harmed the livelihoods of persons who fish for a living. The period before the oil spill was a time of relative prosperity for many commercial fishermen. The years 1987-88 saw some of the highest ever per pound prices for salmon and increased capitalization of the fishery. Thus, fishermen's expectations for income in 1989 were very high, making the fishery closures and other spill effects even more disruptive.

Recovery Objective

Commercial fishing will have recovered when the commercially important fish species have recovered and opportunities to catch these species are not lost or reduced because of the effects of the oil spill.

Recovery Status

Although pink salmon and sockeye salmon are considered to be recovered from the oil spill, recovery is still not complete for Pacific herring (see individual resource accounts), one of the injured resources that is commercially fished. The recovery status of rockfish is still unknown and will likely never be known. No spill-related district-wide fishery closures related to oil contamination have been in effect since 1989. However, the Prince William Sound herring fishery was closed from 1993-96 due to a disease outbreak that may be related to the oil spill, was open to limited commercial harvest in 1997 and 1998, and has remained closed since then. **For these reasons, commercial fishing, as a lost or reduced service, is in the process of recovering from the effects of the oil spill, but full recovery has not been achieved.**

For a variety of reasons, as discussed below, disruptions to income from commercial fishing continue today, as evidenced by changes in average earnings, ex-vessel prices, and limited entry permit values. For example, for the period 1981-2000, fishermen's average earnings in the Prince William Sound salmon seine fishery peaked in 1987 ($176,500), dropped in 1989

by more than half, rebounded in 1990, hit a new low in 1992-93 (runs in 1992-93 were the lowest in 15 years), then hovered somewhat below the 1989 level until 1999-2000, when average earnings climbed to the $130,000 level. Average per-fisher harvests have varied widely during this period, with the three highest years being 1996, 1999, and 2000. Ex-vessel prices were highest in the period 1987-90, and have been below prices of the early 1980s ever since. Limited entry permit prices in this fishery reached a peak in 1989-91, nearly double the price in any earlier year in this period, and have declined since to currently ten percent of their peak price (from $236,000 in 1989 to $22,000 in 2000). The number of permits fished, roughly 250 each year 1981-91, had declined to 130 in 2000.

Natural variability in fish returns and a number of economic changes in the commercial fishing industry since 1989 probably mean that many of these changes in income are not directly attributable to the spill. However, these factors also make discerning spill-related impacts difficult. Economic changes confronting the industry include the increased world supply of salmon (due primarily to farmed salmonids) and corresponding reduced prices, entry restrictions in certain fisheries (such as Individual Fishing Quotas, IFQs, for halibut and sablefish), allocation changes (e.g., a reduction in the allocation of Cook Inlet sockeye salmon to commercial fishermen), changes in processing capacity (closure of major processors in Cordova and Kenai, and a recently announced closure in Larsen Bay on Kodiak Island), and new measures imposed by the North Pacific Fishery Management Council on offshore groundfish fishing to protect the declining number of Steller sea lions.

Although a number of studies aimed at allocating financial impacts to the oil spill versus other factors have been carried out, the federal jury's compensatory award (as opposed to the $5 billion in punitive damages) in the private lawsuit against Exxon is the current legal determination of the liability and damages regarding commercial fishermen (including permit holders, fishing crew, spotter pilots, and vessel owners). The jury award was less than the damage claimed by commercial fishermen and more than that acknowledged by Exxon. In brief, the jury determined that any financial effects on fishermen after 1989, with the exception of the salmon seine fishery in Prince William Sound in 1992-93 and the herring fishery in Prince William Sound in 1993, are not attributable to the spill. The jury considered damage claims for the period 1989-95, including claims related to size of harvest, fish prices, limited entry permit values, and vessel values.

PASSIVE USE

Injury

Passive use encompasses nonuse values, such as the appreciation of the aesthetic and intrinsic values of undisturbed areas and the value derived from simply knowing that a resource exists. Injuries to passive use are tied to public perceptions of injured resources. Immediately following the oil spill, the State of Alaska, using a contingent valuation approach, measured substantial losses of passive use values resulting from the spill. This approach involved surveying a sample of U.S. households to elicit how much people would be willing to pay in additional taxes to fund a program designed to prevent future spills.

Prior to answering the survey questions, respondents were provided information about the spill's impact, including the number of miles of shoreline oiled, an estimate of the number of birds, sea otters, and harbor seals killed, and the conclusion that few fish were harmed, as well as projections of when recovery would occur (typically three to five years).

Recovery Objective

Passive uses will have recovered when people perceive that aesthetic and intrinsic values associated with the spill area are no longer diminished by the oil spill.

Recovery Status

Because recovery of a number of injured resources is incomplete and in some cases has not begun, the Trustee Council considers passive use, as a lost or reduced service, to be recovering from the spill but not yet recovered. In updating the status of passive uses, the Trustee Council has chosen not to repeat the contingent valuation study, which was very expensive and time consuming. However, the key to recovery of passive use is knowing that restoration of injured resources has occurred. Toward this end, in the years since the settlement between Exxon Corporation and the state and federal governments, the Council has undertaken a comprehensive program to restore injured resources and has made a deliberate and consistent effort to inform the public about the status of restoration.

The two key components of the Trustee Council's restoration effort are the research, monitoring, and general restoration program and the habitat protection and acquisition program. The research, monitoring, and general restoration program, which is funded each year through the annual work plan, focuses mostly on knowledge and stewardship as the best tools for long-term health of the marine ecosystem. It also includes development of tools to benefit fisheries management and some direct enhancement activities, such as improving access to spawning habitat. Projects to monitor the status of injured resources, including resources such as killer whales for which no active restoration may be possible, have also been funded through the annual work plan. The habitat protection program preserves habitat important to injured resources through the acquisition of land or interests in land. As of March 2002, the Council has protected more than 643,600 acres of habitat, including more than 1,400 miles of coastline and over 300 streams valuable for salmon spawning and rearing. A summary of the Council's public information efforts follows.

Each year the Trustee Council prepares a number of documents for distribution to the public including; annual work plans, which describe the work underway to restore the injured resources and services; the *Annual Status Report*, which reports to the public on the progress of restoration; and updates to the Restoration Plan (1996, 1999). The Council's annual restoration workshop, which is open to the public, provides another venue for reporting on the progress of restoration. The Council has also published its Restoration Notebook series, which tells the story of injury and recovery from the spill of select injured species.

In addition, from 1996 through early 1999 the Council aired a weekly radio series, "Alaska Coastal Currents", throughout the state. Since 1997, the Trustee Council has had a web site (www.oilspill.state.ak.us) that offers detailed information about restoration efforts.

Project final reports, are also available to the public through the Alaska Resource Library and Information Services (ARLIS) in Anchorage as well as at several other libraries in the state, at the Library of Congress, and through NTIS (National Technical Information Service). In addition, the Council supports researchers in publishing their project results in the peer-reviewed scientific literature, which expands their audience well beyond Alaska. Nearly 500 such papers have been published as of April 2002.

The 17-member Public Advisory Group (PAG), is an important means of keeping stakeholders and others informed of the progress of restoration. In addition to holding quarterly meetings with the Trustee Council staff, in many years the PAG has held an open house in one or more communities in the spill area. Additional public meetings have been held throughout the spill area. All meetings of the Council are widely advertised and opportunity for public comment, is always provided.

RECREATION AND TOURISM

Injury

The oil spill disrupted use of the spill area for recreation and tourism. In addition, resources important to recreation were injured and beaches used for recreational activities were oiled. Recreation was also affected by changes in human use in response to the spill. For example, displacement of use from oiled areas to unoiled areas, particularly in the years immediately following the spill, increased management problems and facility use in unoiled areas.

Recovery Objective

Recreation and tourism will have recovered, in large part, when the fish and wildlife resources on which they depend have recovered and recreation use of oiled beaches is no longer impaired.

Recovery Status

In the years since the spill, there has been a marked increase in the number of visitors to Alaska. Preliminary data for the summer of 2001 indicate over 1.2 million visitors, compared to approximately 600,000 visitors in the summer of 1989. Visitation to the spill area has experienced a similar increase. For example, since 1993 the annual number of visitors to the Kenai Fjords National Park Visitor Center has been nearly double what it was in 1988. In 2000, the number of visitors to the USFS Crooked Creek Visitor Information Center in Valdez was nearly 70 percent greater than in 1989. From 1989 to 1997, the number of sportfishers increased by 65% in Prince William Sound, by 25% in the Kodiak Region, and by 15% in the Kenai Peninsula region. In 2000, the numbers were up slightly for

Prince William Sound and Kodiak, and had decreased slightly for the Kenai Peninsula region.

Even though visitation has increased since the oil spill, however, the Trustee Council's recovery objective requires that the injured resources important to recreation be recovered and recreational use of oiled beaches not be impaired, and this objective has not been met. **Therefore, the Council finds recreation to be recovering from the effects of the spill, but not yet recovered.**

Several resources important for wildlife viewing still are not recovering from the spill or their recovery is unknown, including harbor seal, common loon, cormorant (three species), Kittlitz's murrelet, and pigeon guillemot. Other resources, including sea otter and marbled murrelet, are recovering. The bald eagle, another resource important for wildlife viewing, has recovered from the effects of the spill. (See individual resource accounts for more information on recovery status.)

Telephone interviews were conducted in early 1999 with key informants who recreated extensively in the oil spill area before the spill and currently. Contacted again in 2002, nearly all of the informants commented on increased visitation to the area since the spill. Informants with experience in Prince William Sound continued to report diminished wildlife sightings in the sound, particularly in heavily oiled areas such as around Knight Island. They reported seeing fewer seabirds, killer whales, sea lions, seals, and sea otters than were generally sighted before the spill, but also reported observing increases in the number of seabirds over the last several years. Key informants with experience along the outer Kenai coast reported diminished sightings of seabirds, seals, and sea lions. Changes in the amount of wildlife observed could be due to the oil spill or to other factors.

Sportfishing resources for which the recovery status is unknown are cutthroat trout, Dolly Varden, and rockfish. In 1992-93, in response to evidence of injury to cutthroat trout, emergency closures were put in place in some locations in Prince William Sound. In addition, bag limits have been reduced since 1991 and a closure during the April 15-June 15 spawning season has been in effect since 1994. These measures reflect the management goals for a potentially vulnerable species at the edge of its range. The salmon species that were injured (pink and sockeye salmon) are recovered from the effects of the spill.

Harlequin ducks, which are hunted in the spill area, are still not recovered. The Alaska Board of Game restricted sport harvest of harlequin ducks in western Prince William Sound and Kenai Fjords in 1991. Those restrictions were removed in the 1999-2000 hunting season when sea duck limits were changed statewide to have different limits for resident and non-resident hunters. There are currently no special restrictions for harlequins in Prince William Sound or Kenai Fjords.

Trustee Council sponsored surveys of oiled shorelines indicate that residual oil is still present on some beaches. The results of the most recent survey in Prince William Sound (2001) indicate approximately 20 acres of shoreline are still contaminated with oil. Oil was found at 58 percent of the 91 sites assessed and is estimated to have the linear equivalent of 5.8

kilometers of contaminated shoreline. The most recent survey of the Kenai outer coast and the coast of Katmai National Park (1999) found oil mousse persisting in a remarkably unweathered state on five moderately-to-heavily-oiled boulder-armored beaches (the oil is chemically similar to 11-day old *Exxon Valdez* oil). A survey of 30 oiled sites in the Kodiak Archipelago in 1995 found no oil or only trace amounts.

Key informants telephoned in early 1999 indicated that some beaches in Prince William Sound, particularly in the western portion of the sound, continue to be avoided by some recreational users, particularly kayakers and campers, because of the presence of residual oil. Contacted again in early 2002, informants commented that visitors to the sound routinely inquire about the existence of oil on beaches, either in planning visits or while on tours. They also commented that experienced users of the sound can readily find oil on certain beaches and continue to avoid those areas. Since 1999, informants have indicated that the possible presence of residual oil has no effect on recreational activities along the outer Kenai coast, the Kodiak Archipelago, and the Lake Clark and Katmai national park coastlines.

In 1997, the Trustee Council provided funding for the residents of Chenega Bay, working with the Department of Environmental Conservation, to use PES-51, a citrus-based chemical agent, to clean some of the most heavily-oiled sites near their village. One year later, a statistical analysis showed that the cleanup method reduced the amount of oil remaining on these beaches by a factor of three compared with reductions observed on untreated beaches. However, considerable subsurface oil remains that was inaccessible at the time of treatment, but was uncovered during storms the following winter. NOAA's Auke Bay Lab found no biological injury due to the cleanup.

The State of Alaska dedicated over $10 million of its criminal settlement with Exxon to restoring recreational facilities and use in state parks in the spill area. Improvements include trails, cabins, boat launches, interpretive displays, and campsites. In addition, the Trustee Council funded U.S. Forest Service development of a human use model for western Prince William Sound, which is intended to aid planning for and mitigation of human uses so that injured species continue to be protected. The model may also assist in planning for future recreation needs in the sound.

SUBSISTENCE

Injury

Fifteen predominantly Alaskan Native communities (with a total population of about 2,200 people) in the oil spill area rely heavily on harvests of subsistence resources, such as fish, shellfish, seals, deer, and waterfowl. Many families in other communities also rely on the subsistence resources of the spill area.

Household interviews conducted with subsistence users in communities throughout the spill area in 1989 indicated that subsistence harvests of fish and wildlife in most of the communities declined substantially following the spill. Key factors in the reduced harvests

included reduced availability of fish and wildlife, concern about possible health effects of eating oiled fish and wildlife, and disruption of the traditional lifestyle due to cleanup and related activities.

Recovery Objective

Subsistence will have recovered when injured resources used for subsistence are healthy and productive and exist at prespill levels. In addition, there is recognition that people must be confident that the resources are safe to eat and that the cultural values provided by gathering, preparing, and sharing food need to be reintegrated into community life.

Recovery Status

Household interviews were repeated each year 1990-93 and again in 1998. By 1993, the estimated size of the subsistence harvest and participation in subsistence activities appeared to have returned to prespill levels in some communities, with the harvest rebounding first in the communities of the Alaska Peninsula, Kodiak Island, and the lower Kenai Peninsula and lagging behind a year or more in the Prince William Sound communities.

In 1998, which is the most recent year in which household interviews were conducted, the interviews indicated that subsistence continues to recover from the effects of the oil spill, but has not yet recovered. The percentage of those interviewed who reported that subsistence uses are lower than before the spill has declined. Concerns about food safety and effects on the traditional lifestyle have lessened. Concerns about resource availability and greater harvest effort remain, but harvest levels in all communities interviewed are at or approaching prespill levels. Subsistence harvests in 1998 varied among communities from 250-500 pounds per person usable weight, indicating continued strong dependence on subsistence resources.

Regarding resource availability, subsistence users continued to report scarcity of a number of important subsistence resources, including harbor seals, herring, clams, and crab. These observations are generally consistent with scientific studies funded by the Trustee Council that continue to find that some subsistence species (e.g., harbor seals, Pacific herring, clams) are not recovered from the effects of the spill (see individual resource accounts).

According to those interviewed, the 1998 increase in pounds harvested at a time of continued reduced resource availability reflects greater harvest effort (traveling farther, spending more time and money) than would have been required before the spill to achieve a similar harvest. It also reflects increased reliance on fish in the subsistence diet. Increased fish harvests and decreased marine mammal and shellfish harvests occurred in most communities where interviews were conducted. The cultural and nutritional importance of each resource varies, and these changes in diet composition remain a serious concern to subsistence users.

The decline in shellfish consumption reflects food safety concerns as well as reduced availability of shellfish. From 1989-94, subsistence foods were tested for evidence of hydrocarbon contamination, with no or very low concentrations of petroleum hydrocarbons

found in most subsistence foods. However, because some shellfish can readily accumulate hydrocarbons, subsistence users have been advised not to eat shellfish from beaches where oil can be seen or smelled on the surface or subsurface. By 1998, a large majority of those interviewed expressed confidence about most foods except certain shellfish, such as clams, and concerns about the presence of PSP (paralytic shellfish poisoning) in clams outweighed concerns about lingering hydrocarbon contamination from the oil spill.

Subsistence users continue to emphasize that the value of subsistence cannot be measured in pounds alone. Harvest levels do not encompass the cultural value of traditional and customary use of natural resources. Following the oil spill, there was concern that the spill disrupted opportunities for young people to learn cultural subsistence practices and techniques, and that this knowledge may be lost to them in the future. In 1998, the number of subsistence users reporting a decline in the influence of elders in teaching subsistence skills and values had decreased and the number reporting that young adults are learning enough subsistence skills had increased. Also, the number reporting less sharing of subsistence resources, another integral aspect of subsistence culture, had decreased. However, many of those interviewed continue to express concern about these elements of the traditional lifestyle, with more than 50 percent responding that the traditional way of life has not recovered since the spill.

In the 1998 household interviews, a number of subsistence users commented that some of the current influences on subsistence may not be attributable to the oil spill. Factors such as demographic changes in village populations, ecosystem-wide changes such as ocean warming, increased competition for subsistence resources by other people (e.g., sport fishing charters) and predators (e.g., sea otters), and increased awareness of PSP and other contaminants may play a role in resource availability, food safety, and participation in traditional practices. The Trustee Council will likely repeat the household interviews with subsistence users in communities through the spill area in 2004 or 2005.

KAP 1087: Chokwak Parcel

Acreage: 159.98
Sponsor: ADNR
Appraised Value: $160,000
Owner: James F. Chokwak, Sr.
Location: North Shore of Kiliuda Bay, Kodiak, Alaska.

Parcel Description. The parcel lies at the head of Dog Bay on the north shore of Kiliuda Bay located on the east side of Kodiak Island, approximately 40 miles south of the city of Kodiak. The parcel is a native allotment within the area being acquired by the State as part of the Old Harbor Exchange, currently being pursued according to the purchase agreement with Old Harbor signed in 1999. The exchange is expected to be completed before the end of this summer.

Legal: Lots 1 and 2, U.S. Survey 10885, Alaska, containing 159.98 acres, as shown on the supplemental plat of survey officially filed on April 18, 1997.

Restoration Benefits. Public ownership of this parcel will help to establish a consistent management scheme along the north shore of Kiliuda Bay and maintain the wilderness character of the area.

Although the tract surrounding this parcel, which is part of the Old Harbor Exchange, has extensive coastline, much of it can be characterized as having difficult to access high bluff in areas where moorage is not well protected, with the exception of the head of the bay. Although the bay is suitable for moorage and access by floatplane, on occasion the waters are rough because part of the bay orients towards the Gulf of Alaska and its near horseshoe shape tends to concentrate wave action. The two inholdings in the Dog Bay Old Harbor Exchange parcel provide important access and the most protected moorage to state owned uplands.

The Chokwak parcel includes much of the more level land at the head of the west side of Dog Bay. Along with the other native allotment in Dog Bay it provides the best access to the uplands from anchored boats or floatplanes. The parcel includes a salmon stream, which has silver, chum and pink salmon runs. Further inland, the parcel is characterized by substantial alder patches, high grass and cottonwood.

Appraised Value. $160,000

Proposed Management. The State of Alaska will manage this parcel as wildlife habitat and maintain public access consistent with management of adjacent lands being acquired by the State through the Old Harbor Exchange. A standard BLM conservation easement will be associated with this parcel.

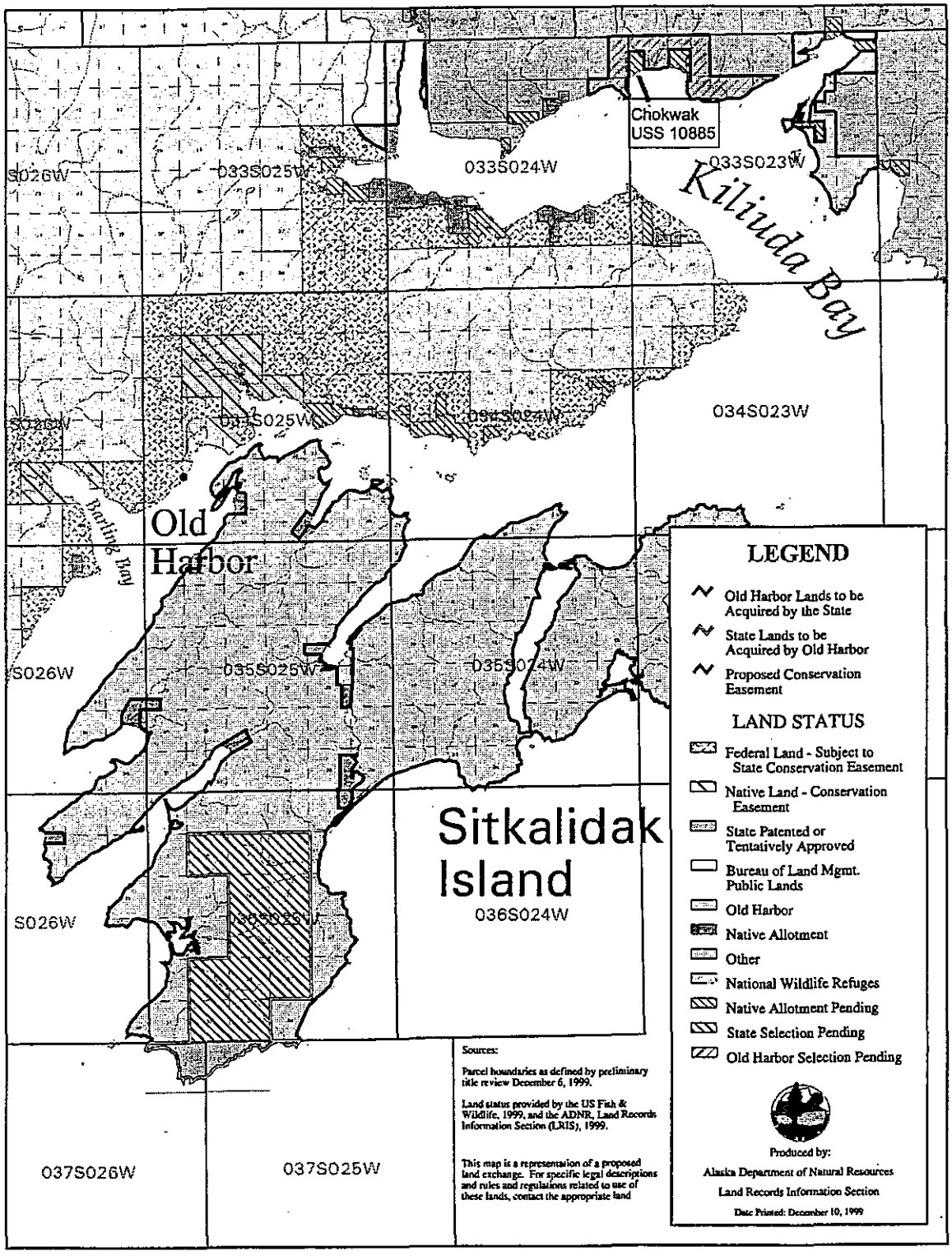
EVOS TRUSTEE COUNCIL

OLD HARBOR EXCHANGE

Scale 1:150,000

0 5.0 miles

Albers Equal-Area Projection



DRAFT

RESOLUTION 02-06 OF THE *EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL REGARDING SMALL PARCEL KAP 1087/CHOKWAK

We, the undersigned, duly authorized members of the *Exxon Valdez* Oil Spill Trustee Council ("Council"), after extensive review and after consideration of the views of the public, find as follows:

1. By resolution adopted at its meeting on January 16, 2001, the Council implemented a small parcel acquisition program through identical grants to The Conservation Fund and The Nature Conservancy (the grant to The Conservation Fund is hereinafter referred to as the "Grant");

2. The Conservation Fund and The Nature Conservancy identified the Chokwak small parcel, KAP 1087 as a small parcel to be considered for acquisition under the Grant and consulted with the Council at its meeting on December 11, 2001 concerning the purchase of the Chokwak parcel;

3. An appraisal of the parcel completed by the Bureau of Indian Affairs of the United States Department of the Interior determined that the fair market value of the parcel is $160,000;

4. As set forth in Attachment A, Restoration Benefits Report for KAP 1087, if acquired, this small parcel has attributes which will restore, replace, enhance and rehabilitate injured natural resources and the services provided by those natural resources, including important habitat for several species of fish and wildlife for which significant injury resulting from the spill has been documented. Acquisition of this small parcel will assure protection of approximately 160 acres. The parcel includes much of the more level land at the head of the west side of Dog Bay. Along with the other native allotment in Dog Bay it provides the best access to the uplands from anchored boats or floatplanes. The parcel includes a salmon stream, which has silver, chum and pink salmon runs. Further inland, the parcel is characterized by substantial alder patches, high grass and cottonwood. The parcel is important to the sport fishing and tourism industries, both of which were impacted by the *Exxon Valdez* Oil Spill ("EVOS").

5. Existing laws and regulations, including but not limited to the Alaska Forest Practices

Act. the Alaska Anadromous Fish Protection Act. the Clean Water Act. the Alaska Coastal Management Act. the Bald Eagle Protection Act and the Marine Mammal Protection Act. are intended. under normal circumstances, to protect resources from serious adverse effects from activities on the lands. However, restoration, replacement and enhancement of resources injured by the EVOS present a unique situation. Without passing judgment on the adequacy or inadequacy of existing law and regulations to protect resources, scientists and other resource specialists agree that, in their best professional judgment, protection of habitat in the spill area to levels above and beyond that provided by existing laws and regulations will have a beneficial effect on recovery of injured resources and lost or diminished services provided by these resources;

6. There has been widespread public support for the acquisition of lands within Alaska as well as on a national basis;

7. The purchase of this parcel is an appropriate means to restore a portion of the injured resources and services in the oil spill area. Acquisition of this parcel is consistent with the Final Restoration Plan.

THEREFORE, we resolve to provide funds to the United States Department of Interior for purchase by the State of Alaska of all the seller's rights and interests in the small parcel KAP 1087 pursuant to the following conditions:

(a) the amount of Grant funds (hereinafter referred to as the "Purchase Price") to be provided by the Council shall be one hundred sixty thousand dollars ($160,000) for small parcel KAP 1087;

(b) authorization for funding for the acquisition described in the foregoing paragraph shall terminate if a purchase agreement is not executed or purchase of the parcel completed by August 30, 2003;

(c) filing by the United States Department of Justice and the Alaska Department of Law of a notice, as required by the Third Amended Order for Deposit and Transfer of Settlement Proceeds, of

the proposed expenditure with the United States District Court for the District of Alaska and, if necessary, with the Investment Fund established by the Trustee Council within the Alaska Department of Revenue, Division of the Treasury ("Investment Fund") and transfer of the necessary monies from the appropriate account designated by the Executive Director of the Trustee Council ("Executive Director");

(d) a conservation easement on parcel KAP 1087 shall be conveyed to the United States which must be satisfactory in form and substance to the United States and the State of Alaska Department of Law;

(e) no timber harvesting, road development or any alteration of the land will be initiated on the land without the express agreement of the State of Alaska and the United States prior to purchase; and

(f) compliance with the terms and conditions of Paragraph 6.b. of the Grant.

It is the intent of the Trustee Council that the above referenced conservation easement will provide that any facilities or other development on the foregoing small parcel shall be of limited impact and in keeping with the goals of restoration, that there shall be no commercial use except as may be consistent with applicable state or federal law and the goals of restoration to prespill conditions of any natural resource injured, lost, or destroyed as a result of the EVOS, and the services provided by that resource or replacement or substitution for the injured, lost or destroyed resources and affected services, as described in the Memorandum of Agreement and Consent Decree between the United States and the State of Alaska entered August 28, 1991 and the Final Restoration Plan as approved by the Council.

By unanimous consent, following written notice from the Executive Director that the terms and conditions set forth herein have been satisfied, we request the Alaska Department of Law and the Assistant Attorney General of the Environment and Natural Resources Division of the United States Department of Justice to take such steps as may be necessary for withdrawal of the Purchase Price for the above-referenced parcel from the appropriate account designated by the Executive Director.

Such amount represents the only amount due under this resolution to the sellers by the State of Alaska to be funded from the joint settlement funds, and no additional amounts or interest are herein authorized to be paid to the sellers from such joint funds.

Approved by the Council at its meeting of July 9, 2002 held in Anchorage, Alaska, as affirmed by our signatures affixed below:

DAVE GIBBONS
Forest Supervisor
Forest Service Alaska Region
U.S. Department of Agriculture

CRAIG TILLERY
Assistant Attorney General
State of Alaska

DRUE PEARCE
Senior Advisor to the Secretary
for Alaskan Affairs
U.S. Department of the Interior

JAMES BALSIGER
Administrator, Alaska Region
National Marine Fisheries Service

FRANK RUE
Commissioner
Alaska Department of
Fish and Game

MICHELE BROWN
Commissioner
Alaska Department of
Environmental Conservation

Attachment A - Restoration Benefits Report

MEMORANDUM

State of Alaska
Department of Law

To:	EVOS Trustee Council Molly McCammon	Date:	July 2, 2002
		File No.:	N/A
		Tel No.:	269-5274
From:	Alex Swiderski Department of Law	Subject:	Sitkalidak Exchange

INTRODUCTION

In September 1998 the Trustee Council agreed to provide $73,500 for the State of Alaska and Old Harbor Native Corporation (OHNC) to pursue an equal value land exchange. Pursuant to the exchange the state would convey all of its holdings on Sitkalidak Island to OHNC and in return receive title to lands along the north shore of Kiliuda Bay. An appraisal approved by state and federal review appraisers has estimated the value of the lands to be conveyed by OHNC to be $1,572,000 and $1,531,000 for the lands to be conveyed by the state, a difference of $41,000.

The question before the Trustee Council is whether to provide an additional $41,000 for the Alaska Department of Natural Resources to equalize the values of the lands to be exchanged. The state and OHNC have reached the final steps in the land exchange and expect to complete the exchange prior to September of this year.

DISCUSSION

Following completion of the appraisals the OHNC and the State initially considered equalizing the value of the lands to be exchanged by OHNC withholding approximately 41 acres from the exchange. This was a less than satisfactory solution because it created an inholding in an area where the State hoped to avoid inholdings. The parties then agreed to seek funding to equalize the values and secured a commitment from The Conservation Fund to attempt to identify funds that could be used to equalize the values. However, The Conservation Fund has recently advised that it has not been able to procure the $41,000.

The exchange would benefit the state in that it would give title to shoreline lands adjacent to other state owned uplands, thus providing shoreline access to those uplands. The exchange would benefit OHNC by giving it title to virtually all of Sitkalidak Island where OHNC intends to concentrate its ecotourism and other economic development efforts. The exchange would consolidate the holdings of both parties.

Pursuant to the terms of the exchange agreement the lands to be acquired by the state must be managed as wildlife. The adjacent lands already under state ownership are

also managed as wildlife habitat. Completion of the exchange will result in the protection of significant natural resources including harbor seals, bald eagles, strong runs of chum and pink salmon, Kodiak brown bears and deer. Completion of the Old Harbor Exchange will protect the major salmon spawning systems in Kiliuda Bay. Abundance of brown bears is dependent upon large tracts of unfragmented habitat and strong runs of salmon. Recreational hunting and fishing will also benefit from improved access to the Shearwater Peninsula. Further improvements in public access will result from the acquisition of remaining inholdings from willing sellers.

MOTION

In the event that the Trustee Council decides to provide $41,000 for the Alaska Department of Natural Resources to equalize the values of lands to be exchanged and complete the land exchange between the State and OHNC, a motion to effect that decision would be as follows:

It is moved that $41,000 be provided to the Alaska Department of Natural Resources to be used to equalize the values of the lands on Sitkalidak Island to be conveyed by the State of Alaska to OHNC for lands in Kiliuda Bay to be conveyed to the State by OHNC.

cc: Regina Belt
Barry Roth
Maria Lisowski

The Nature Conservancy OF ALASKA

421 West First Avenue
Suite 200
Anchorage, Alaska 99501
TEL (907) 276-3133
FAX (907) 276-2584
rhagenstein@tnc.org

Int'l Headquarters
Arlington, Virginia
TEL (703) 841-5300

8 July, 2002

To: Exxon Valdez Oil Spill Trustee Council

Re: Status Report – Small Parcel Grant Agreement

Dear Trustees:

The purpose of this document is to provide you with an update on The Nature Conservancy's progress under the grant through the U.S. Fish and Wildlife Service to the Conservancy and The Conservation Fund to acquire habitat important to the long-term restoration of species and services injured by the 1989 *Exxon Valdez* oil spill.

The table below summarizes the properties on which the Conservancy is actively negotiating. All of these properties have been through the consultation process with the Trustees with the exception of the McGee tract on the Anchor River. I have coordinated with the relevant management agency staff in each case and both DNR and ADFG staff have expressed strong support for these acquisitions.

Location:	Owner:	Acres:	Value estimate:	Receiving agency:
Anchor River	McGee	8	$ 50,000	Alaska State Parks
Anchor River	Knol	37	100,000	ADFG
Anchor River	Nakada	5	30,000	ADFG
Anchor River	Thompson	64	90,000	ADFG
Nuka Island	Univ. of Alaska	46	235,000	Alaska State Parks

Let me expand a bit on each of these projects. I have also included maps showing specific parcel locations.

Anchor River – McGee tract: This parcel is one of three private parcels at the mouth of the Anchor River that (together with existing state lands) comprise the entirety of the rich salt marsh, estuary, and barrier beach complex at the mouth of the river. This productive estuary is used extensively by migrating and rearing king and coho salmon and steelhead. Bald eagles concentrate here to feed, and migratory waterfowl and shorebirds migrate through in spring and fall. The barrier beach also supports one of Alaska's most popular sport fisheries. The State of Alaska in conjunction with the Conservancy and Kachemak Heritage Land Trust was successful in securing a $310,000 National Coastal Wetlands Grant that will be used to purchase two of the three private tracts at the mouth of the Anchor. We would like to use EVOS small parcel funds to secure the final parcel. The McGee property is currently being appraised.

Anchor River – Knol, Nakada and Thompson tracts: Approximately eight miles upstream from the mouth of the Anchor River are a series of properties in various stages of negotiation. The three tracts listed above, when combined with existing state lands and properties owned by the Kachemak Heritage Land Trust, will protect over two miles of river frontage and 500 acres of intact floodplain communities. This portion of the Anchor provides rearing habitat for several species of anadromous fish and provides some of the best steelhead fishing in the state. Bald eagles nest and feed extensively along this portion of the river. Finally, the lower floodplain provides critical overwintering habitat for moose. The Conservancy purchased the Knol property last winter for $80,000. We are currently getting an appraisal on the Thompson tract and have a willing seller if the prices work out. We have negotiated a bargain sale (i.e., below fair market value (FMV) with donative intent) at $15,000 on the Nakada property and have secured private funding for this property. When secured, we intend to donate the property to the state as part of this 3-property transaction. As above, these deals are significantly leveraged through below-FMV sales and private funding.

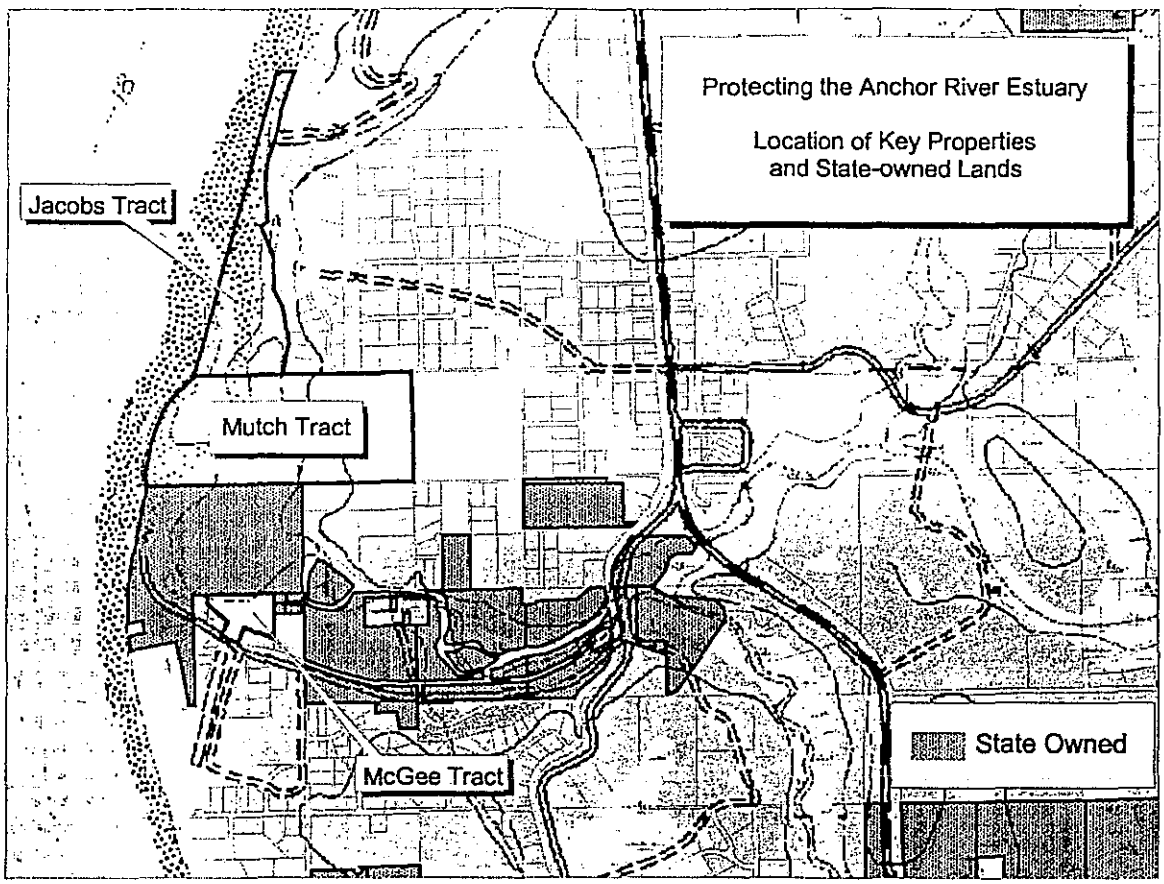
Nuka Island – University of Alaska tracts: The University owns two 23 acre properties on the west side of Nuka Island on the outer coast of the Kenai Peninsula. These properties are the only two inholdings on the island; the balance of the land is within Kachemak Bay State Park. The shoreline of Nuka Island provides protected habitats for sea otters, harbor seals, and other marine species. Four anadromous streams enter marine waters of Nuka Passage adjacent to the University parcels. The island provides nesting habitat for harlequin ducks and bald eagles. A wide variety of seabirds feed in adjacent waters. Horan & Corak have provided an initial opinion of value, and the University has indicated a willingness to sell at the mid-point of the value range or $235,000. We are currently getting a full appraisal on the property.

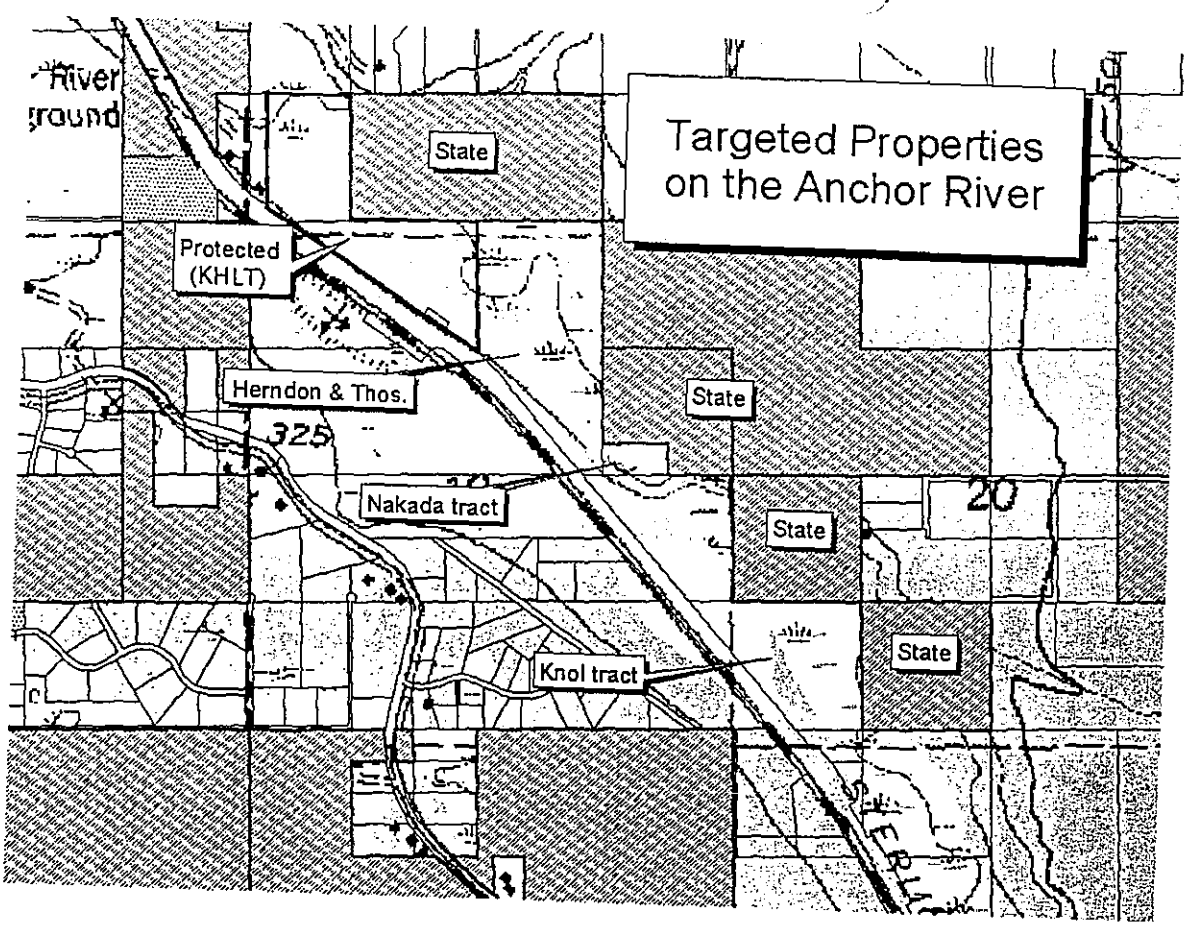
On a related note, the Conservancy is also negotiating with the University on the lands the Chugach National Forest hopes to acquire in Prince William Sound including 33 acres in the Valdez Duck Flats and 925 acres in Jack Bay. We are currently getting the appraisals updated on these properties. The funds for these parcels have already been approved by the Trustee Council and are not part of the small parcel grant through USFWS.

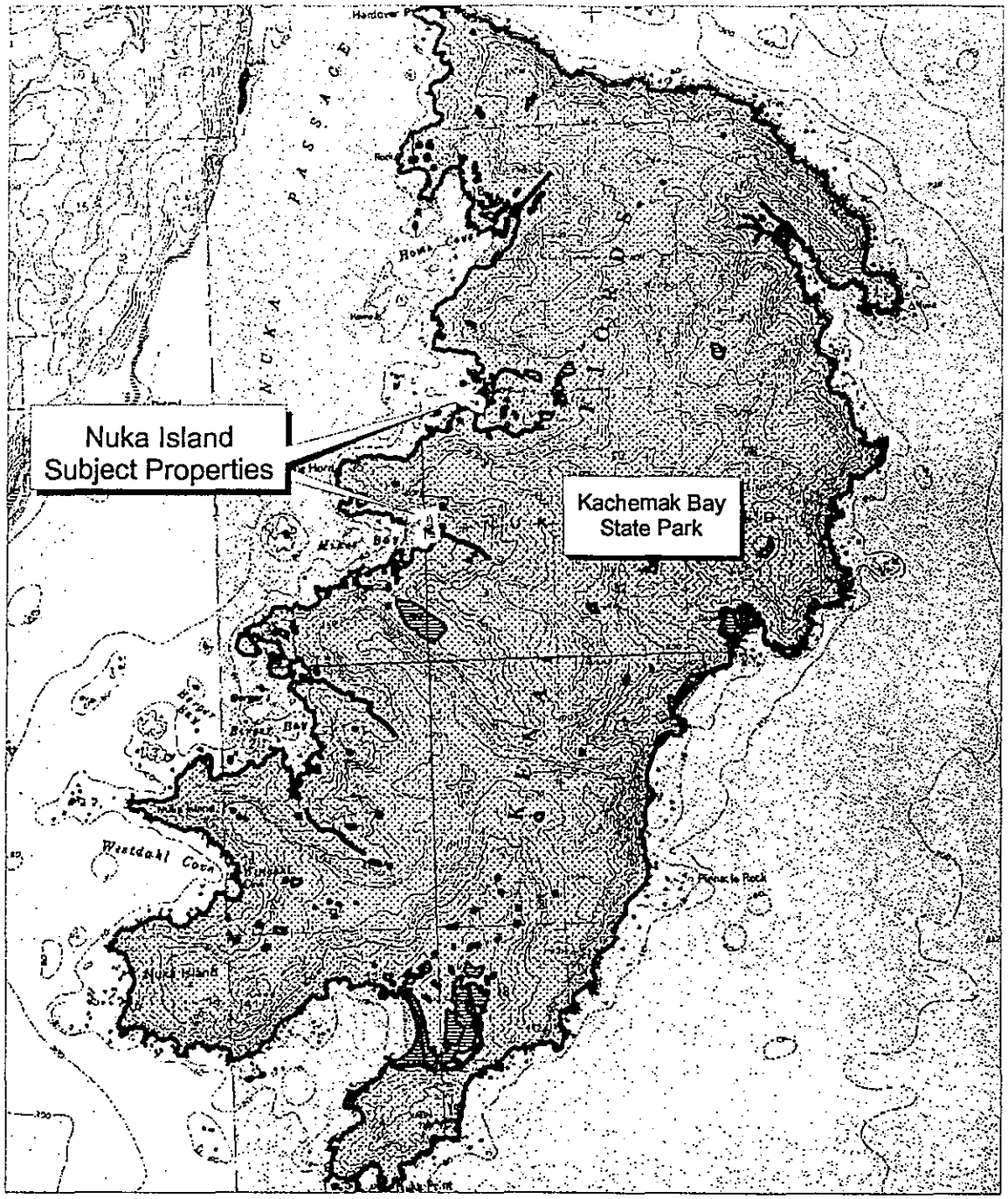
I look forward to working with the Trustee Council to complete the projects listed above by October 2002. We intend to bring a full package of information on each of these properties for a decision by the Trustee Council in August or September.

Sincerely,

Randall H. Hagenstein
Director of Land Protection


Protecting the Anchor River Estuary
Location of Key Properties
and State-owned Lands
Jacobs Tract
Mutch Tract
McGee Tract
State Owned


Targeted Properties
on the Anchor River
State
Protected
(KHLT)
Herndon & Thos.
325
State
Nakada tract
State
20
State
Knol tract


Nuka Island
Subject Properties
Kachemak Bay
State Park
NUKA PASSAGE
Wetlands
Anadromous Streams

THE CONSERVATION FUND

9850 Hiland Road
Eagle River, Alaska 99577
(907) 694-9060/694-9070 FAX

9 July, 2002

To: Exxon Valdez Oil Spill Trustee Council

Re: Status Report – Small Parcel Grant Agreement

Dear Trustees:

The purpose of this document is to provide you with an update on The Conservation Fund's progress under the grant through the U.S. Fish and Wildlife Service to the Conservancy and The Nature Conservancy to acquire habitat important to the long-term restoration of species and services injured by the 1989 *Exxon Valdez* oil spill.

The table below summarizes the properties on which the Fund is actively negotiating. All of these properties have been through the consultation process with the Trustees.

Location:	Owner:	Acres:	Appraised Value	Receiving agency:
Kiliuda Bay, Kodiak Island	Chokwak	160	$ 160,000	ADNR
Anchor River	Kurka	40	200,000	ADFG
Anchor River	Swartzes	.19		ADFG

Let me expand a bit on each of these projects. I have also included maps showing specific parcel locations.

Kiliuda Bay – Chokwak tract: This is located on the north shore of Kiliuda Bay on the east side of Kodiak Island. The Chokwak tract is embedded within the lands the State expects to receive under the pending exchange between the State and the Old Harbor Native Corporation. The property has particular value to bald eagles, pink and silver salmon, and herring that spawn in Kiliuda Bay. The property has been appraised, a hazardous materials site inspection has been made, and the owner has indicated a willingness to sell at the appraised value.

Anchor River – Kurka: The Kurka property is located on the south end of the North Fork Road, 1000' east of the Sterling Highway and 8.5 miles north of Homer. The property lies along the north bank of the South Fork of the Anchor River, and consists of a 23-lot subdivision, with 14 lots fronting on the river. The Anchor offers some of the best steelhead fishing in the state, and the Kurka property would provide sportfishing access. The property has been appraised and the owner has indicated a willingness to sell at the appraised value.

Ninilchik River – Swartzes: This tract, previously known to the Trustee Council as KEN 310, is located along the lower Ninilchik River. The public has used this area of the Ninilchik River for decades while pursuing the popular king salmon fishery each spring, and later in the season for Dolly Varden, silver salmon, and steelhead. The Ninilchik is one of the finest bank-accessible sport fisheries for king salmon on the Kenai Peninsula, and is extremely popular and productive. The Swartzes tract abuts the recently-acquired Icicle Seafoods property and other State-owned property.

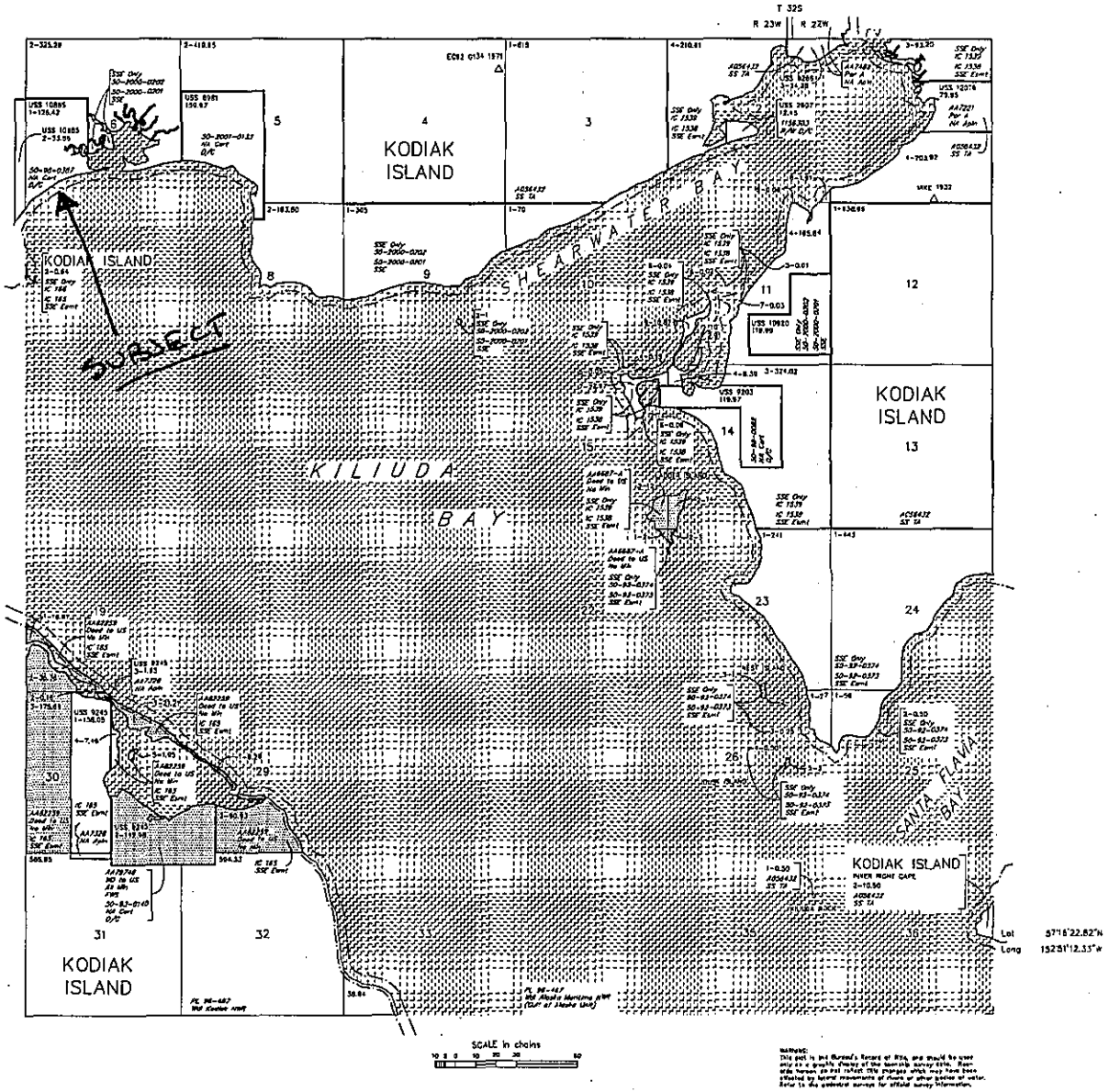
I look forward to working with the Trustee Council to complete the projects listed above.

Sincerely,

Brad Meiklejohn
Alaska Representative

CHOKWAK

SURVEYED TOWNSHIP 33 SOUTH, RANGE 23 WEST OF THE SEWARD MERIDIAN, ALASKA



STATUS OF PUBLIC DOMAIN LAND AND MINERAL TITLES AND ACQUIRED LANDS

MTP

FOR ORDERS EFFECTING DISPOSAL OR USE OF UNIDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION MINERALS, WATER AND/OR OTHER PUBLIC PURPOSES REFER TO INDEX OF MISCELLANEOUS DOCUMENTS

PL 92-203 Wdl AA5587 Lds W/I AA5557-A

PLO 5183 Wdl CI & Add of Leg Lds/interests not conveyed

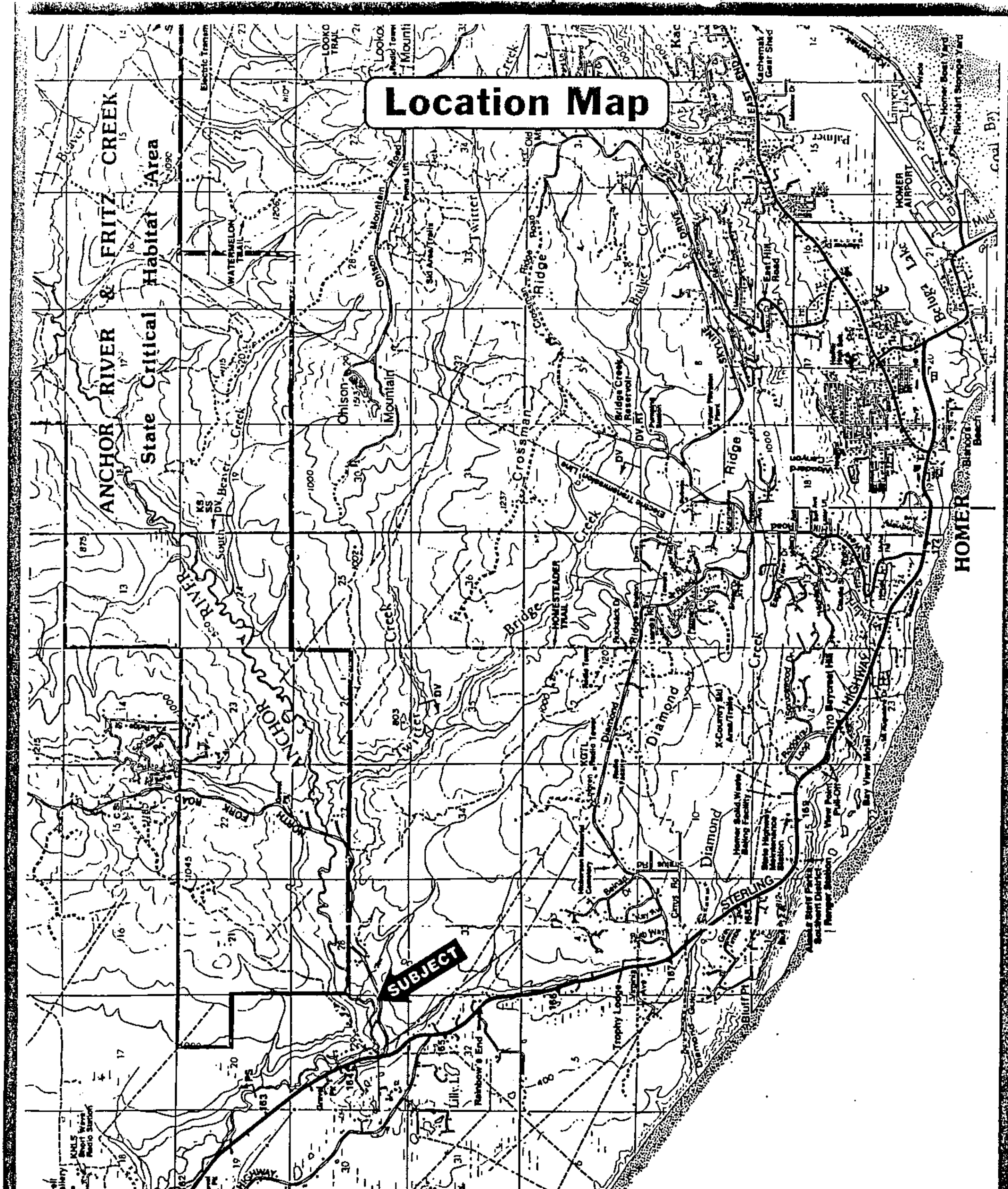
CURRENT TO	FWS
10-1-2001	

Seq Mer T 33 S R 23 W

Acq

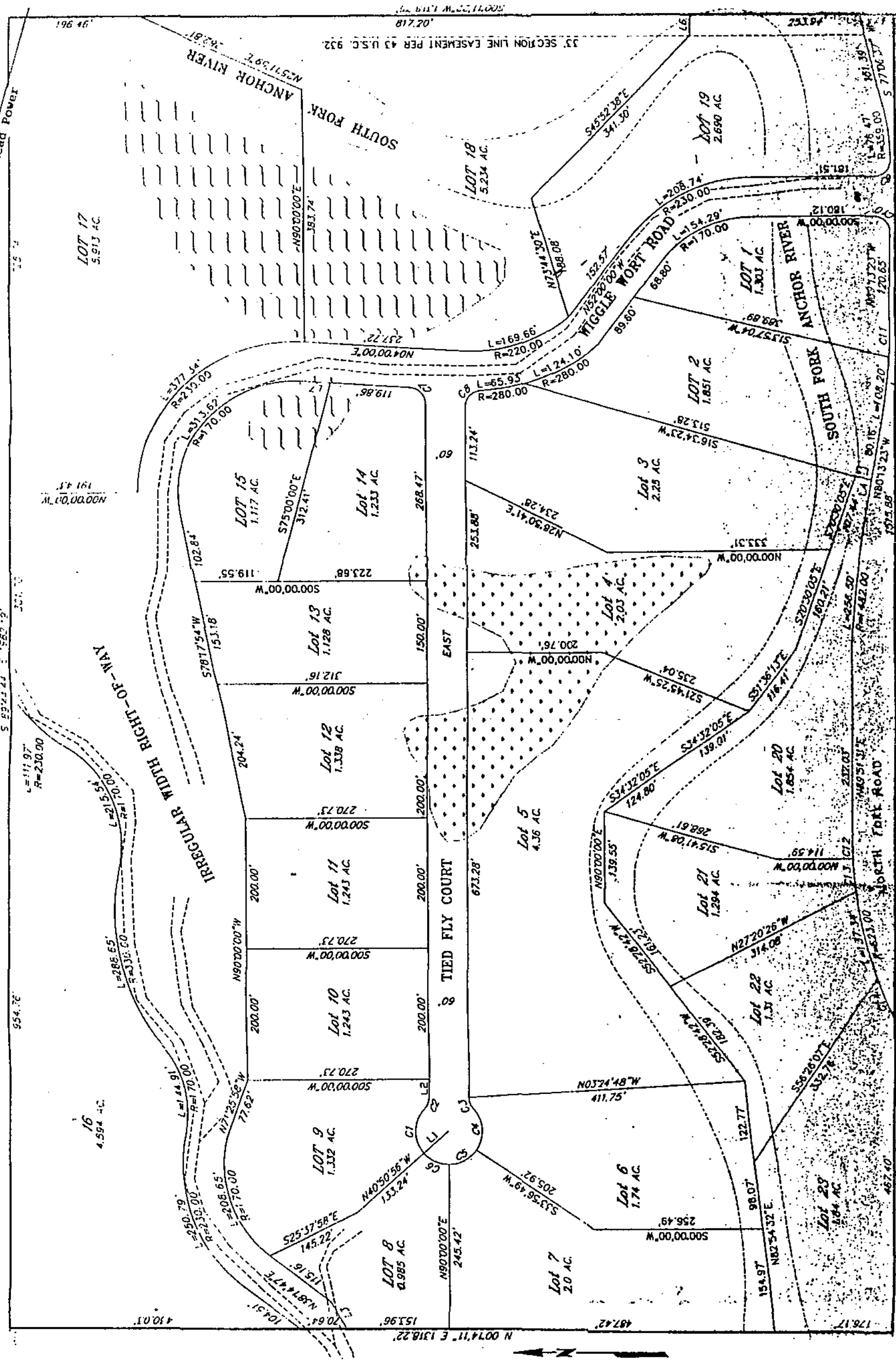
ACAD

KURKA

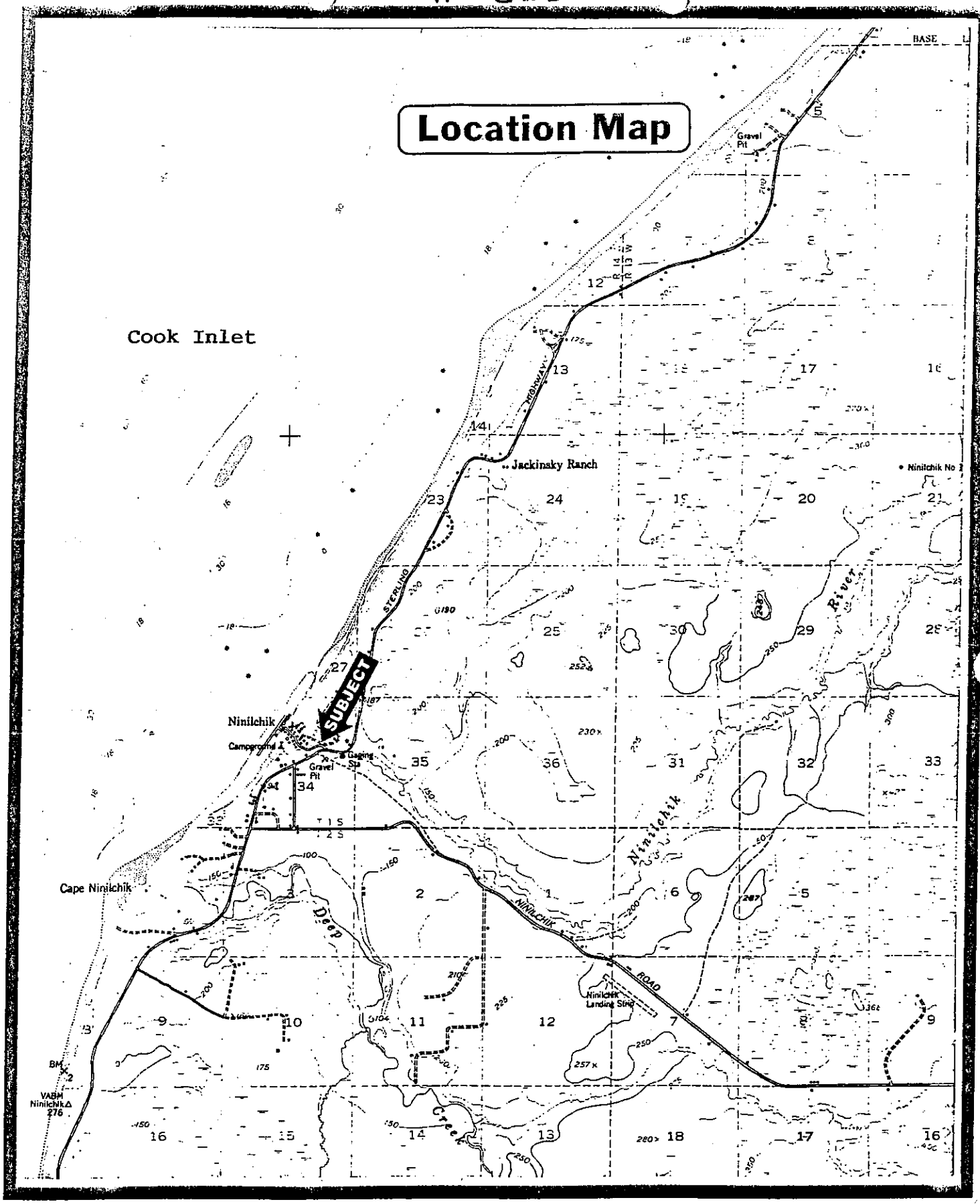


DERRY & ASSOCIATES, Inc.

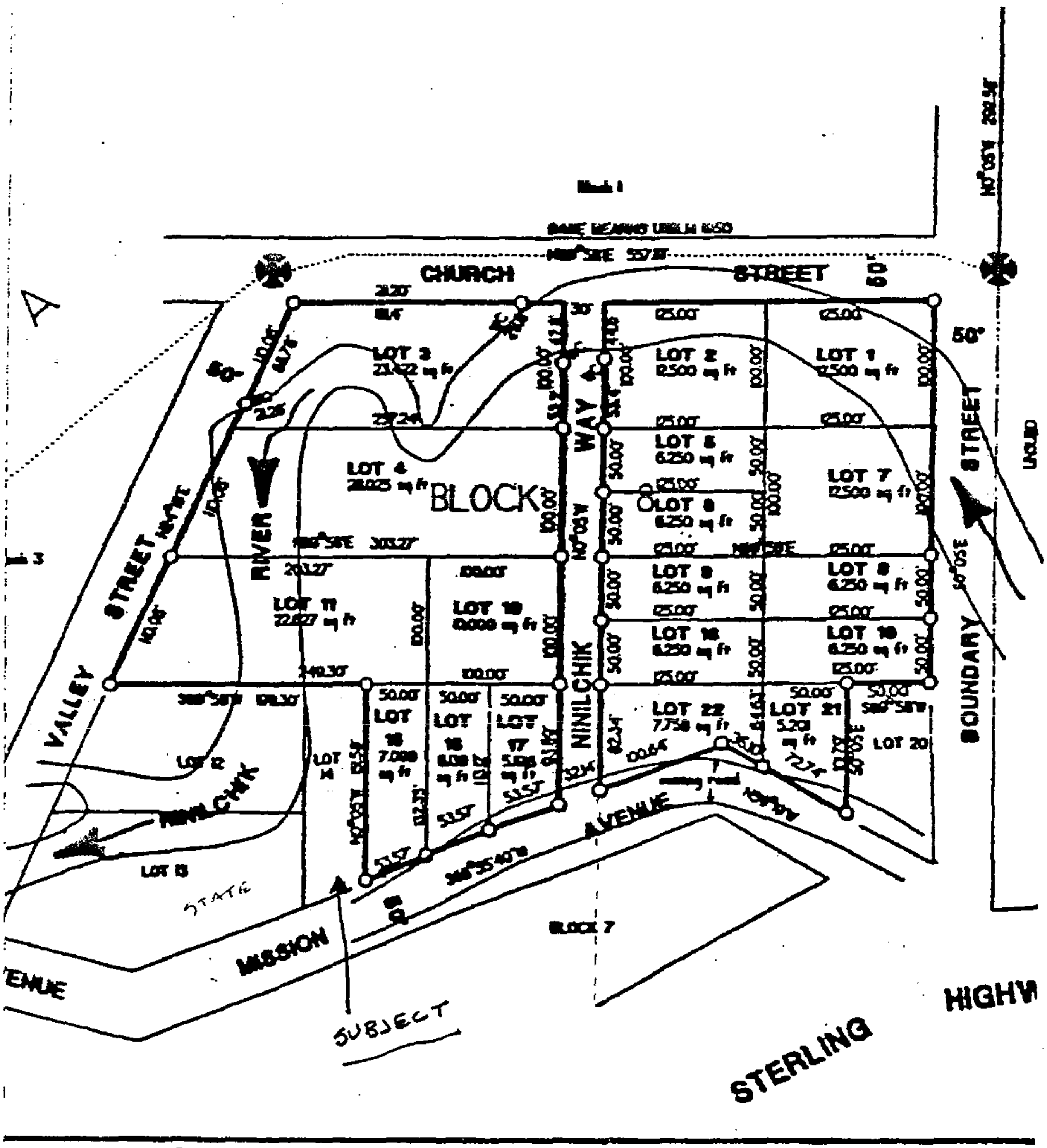
KURKA


TIED FLY COURT
WIGGLE WORT ROAD
NORTH FORK ROAD
IRREGULAR WIDTH RIGHT-OF-WAY
SOUTH FORK ANCHOR RIVER
33' SECTION LINE EASEMENT PER 43 U.S.C. 932
Overhead Power
LOT 1 1.303 AC.
LOT 2 1.851 AC.
Lot 3 2.25 AC.
Lot 4 2.03 AC.
Lot 5 4.36 AC.
Lot 6 1.74 AC.
Lot 7 2.0 AC.
LOT 8 0.985 AC.
LOT 9 1.332 AC.
Lot 10 1.243 AC.
Lot 11 1.243 AC.
Lot 12 1.338 AC.
Lot 13 1.128 AC.
Lot 14 1.233 AC.
LOT 15 1.117 AC.
16 4.594 AC.
LOT 17 5.913 AC.
LOT 18 5.234 AC.
Lot 19 2.690 AC.
Lot 20 1.854 AC.
Lot 21 1.294 AC.
Lot 22 1.31 AC.
Lot 23 1.84 AC.
N 00°14'11" E 1318.22'
S89°43'50"E 1993.28'

SWARTZES



DERRY & ASSOCIATES, Inc.


CHURCH
STREET
LOT 3
21,422 sq ft
LOT 2
12,500 sq ft
LOT 1
12,500 sq ft
LOT 4
28,025 sq ft
BLOCK
LOT 5
6,250 sq ft
LOT 6
6,250 sq ft
LOT 7
12,500 sq ft
LOT 9
6,250 sq ft
LOT 8
6,250 sq ft
LOT 11
22,627 sq ft
LOT 10
10,000 sq ft
LOT 22
7,738 sq ft
LOT 21
5,201 sq ft
LOT 20
LOT 16
7,080 sq ft
LOT 17
LOT 12
LOT 13
LOT 14
RIVER
WAY
NINILCHIK
VALLEY
STREET
BOUNDARY
STREET
NINILCHIK
MISSION
AVENUE
BLOCK 7
STERLING
HIGHW
STATE
SUBJECT

SWARTZES

July 3, 2002

Exxon Valdez Oil Spill Trustee Council
441 W. 5th Avenue, Suite 500
Anchorage, AK 99501-2340

Dear Members and Staff of the EVOS Trustee Council:

I appreciate the opportunity to weigh in on your proposed changes to the status of recovery of species injured from Exxon's oil spill.

I strongly request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. Harlequin Ducks, Herring, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats-- be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications. Public education about the status of species is an important responsibility of the Trustee Council and these recovery and lack-of-recovery findings must continue to be made available to the general public.

Thank you for the opportunity to comment.

Sincerely,

Maryellen Oman

Maryellen Oman
12951 Summer Circle
Anchorage, AK 99516-2629

Molly McCammon

From: Carol Hoover [hooves@redzone.org]
Sent: Wednesday, July 03, 2002 12:53 PM
To: molly_mccammon@oilspill.state.ak.us
Subject: Comment letter

Dear Molly:

I have been working in Cordova since 1994 - and am friends and associates with many who love, work and do science in the Sound.

It is NOT recovered. Many species that we know of, and many species sytems that are not listed may not be recovered. The Orcas are NOT - this is a fact. The
Harlequin Ducks, Herring, Clams and Sea Otters are NOT - this is a fact. There is oil on the beaches still polluting the environement. There are no herring. The people of the area are still suffering economic, pshycological and physical trauma from the spill. That is a fact.

The fact that the Council is even considereing giving these species and others in the Sound a recovered status is undeniably unsound, unwise, unfair and smacks of a strange sense of blind values. I feel that it will take courage to tell the truth in this situation and for some reason we are not aware of, there seems to be a push to declare theses species, and the Sound for that matter, as recovered.

As I am sure you may know, we know now that it is only one part per billion of oil pollution in salt water that causes harm to the reproductive abilities of salmon and other wildlife - NOT one part per million as was thought at the time of the spill. What else will we find out in the future about the harm that this disasterous spill has caused?

It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications. Public education about the status of species is an important responsibility
of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

Thank you.
Best regards,
Carol Hoover

--
Carol Hoover
Eyak Preservation Council
PO Box 460
Cordova, AK 99574
907 424 5890 v
907 424 5891 f
www.redzone.org

Molly McCammon

From: scott metzger [slm@adnmail.com]
Sent: Wednesday, July 03, 2002 3:30 PM
To: molly_mccammon@oilspill.state.ak.us
Subject: official public comments

EVOS Trustees Council, July, 3,2002

The following are my official public comments regarding the recovery status of the 9 species up for reconsideration by the Council. This is in regards to the 25 species injured by the Exxon Valdez Oil Spill.

First of all it is my opinion that the only factor that should affect whether a species is listed as "not recovered", "recovering", or "recovered" should be solid scientific evidence. This should not be a politically motivated decision making process and if there is not enough evidence to support a "recovered" listing, then no species should be listed as "recovered".

In the instances where there is not enough scientific iformation gathered or the studies remain inconclusive, the most scientifically sound thing to do would be to list those species as "recovery unkown" or "not recovered."

The AB Pod of Killer Whales has shown a low birth rate, high calf mortality, and is still 10 whales short of the pre spill population size. Based on these facts the AB pod should remain classified as "RECOVERING", or "NOT RECOVERED".

Based on new studies completed in 2001 by NOAA, there is evidence that oil still exists on most of the heavily oiled beaches in PWS. The affects of this lingering oil on intertidal invertebrates is still completely unknown. Therefore it is premature to classify Clams, herring, Harlequin ducks, and sea otters as anything but "RECOVERY UNKNOWN", or "NOT RECOVERING". All of these species rely on intertidal areas for foraging and reproduction. These species cannot be recovered when the lingering affects of this oil remain unstudied.

Thank you , Sincerely, Scott Metzger

Molly McCammon

From: Leo & Dorothy Keeler [info@akwildlife.com]
Sent: Wednesday, July 03, 2002 9:29 PM
To: molly_mccammon@oilspill.state.ak.us
Subject: Draft Update to Injured Resources

Dear Members and Staff of the EVOS Trustee Council,

I appreciate the opportunity to address your proposed changes to the status of recovery of species injured from Exxon's oil spill.

I emphatically request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. Harlequin Ducks, Herring, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats-- be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications.

Public education about the status of species is an important responsibility of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

Thank you for the opportunity to comment.

Signed,

Dorothy Keeler

Wilderness Inspirations™
P.O. Box 190647
Anchorage, Alaska 99519
(907)248-9916
fax(907)248-8589

Molly McCammon

From: Lauren Joy Padawer [laurenjoy@redzone.org]
Sent: Thursday, July 04, 2002 4:06 AM
To: molly_mccammon@oilspill.state.ak.us
Subject: Exxon Valdez Oil Spill Trustee Council public comment

Dear Ms. Molly McCammon-

In regards to your recent debate about the contention between policy and scientific questions, I offer the following opinions as a citizen, an ecologist, and as a public interest activist.

When the Council has "no new evidence", should a species or resource not be moved to the 'recovery' line? I believe that EVOS needs to use language that is clearly understood for use with the public in media and reports. It is highly confusing to call a species 'recovered' when the science is NOT 100% conclusive. As long as population numbers are not recovered to prespill conditions, it is unacceptable and misleading to label them as 'recovered'. This I perceive as a tool conceived by oil corporate-funded politicians and Trustee Council members to usurp the truth from scientists and community members in the Sound who have seen continuing devastation to animals and habitat.

We're hearing a lot about the listing being a "public education tool" from the oil spill (not including global warming, tourism and other issues). When we list a species as recovered, the public thinks that means the species is healthy overall, how can we address this? It is clear that in ALL cases, the public needs to understand that the oil is NOT cleaned up, that it is impossible to clean up oil spills, and that oil is extremely toxic as water-soluble fractions (WSF's) and extremely hazardous as polycyclic aromatic hydrocarbons (PAH's), whether from spilled oil OR carbon emissions to humans, aquatic and terrestrial plant and animal life.

"We know there is still oil in the environment-large amount-could be there over 100 years, or longer. We know all these species at some stage of their life cycle will encounter this. Does that prohibit recovery? Some are looking for zero tolerance oil exposure. How can we address this issue?" I believe the environment has an incredible power to recover itself from human accidents and thoughtless destruction. However, the timeline for this kind of renewal takes anywhere from 10-800 years depending on the amount and type of degradation. Clearly, the amount of oil spilled in the Sound in 1989 is astounding and much larger than Exxon claimed in public press - almost 38 million gallons I understand is a closer calculation. I am not looking for 'zero-tolerance' as you put it, but rather an acceptance that this oil spill has left indelible psychological and abiding physical marks on the Sound ecosystem. As long as numbers are below pre-spill levels, the oil will remain a toxin in the Sound ecosystem. If after 100 years there are still species that have not reached pre-spill numbers, the EVOS Trustee Council will still be unable to call those species or the ecosystem recovered.

Craig Tillery commented that perhaps they could use the 'recovery unknown' catergory or more precise labeling that would maintain their credibility in the scientific community as well as to provide pubic education. I think this is very appropriate.

Bob Spies, chief scientist, asked "how precautionary should we be? Trustee council risks some credibility if it goes too far towards an extreme conservation definition." Conservation is preserving what has not yet lost integrity. Unfortunately, the Sound ecosystem has lost its pristine integrity forever. While problems are not apparent on the surface, they are exceedingly apparent under the microscope. This camera-view perspective has been a prevalent problem over the last 13 years and a problem which Exxon Corporation has capitalized on. Wherever possible, Exxon Corporation has portrayed a recovered version of the Sound. How can this be when our science clearly shows the contrary? It wouldn't be the case if money did not equal media angle.

So, to be precautionary, would be to honor the damage by continuing studies and distilling already published information about ecological damage in the Sound. It will prove time and again that oil is a hazardous substance dangerous to the

world in the form of emissions, risky to transport in our shared oceans, and toxic to oil industry workers, clean-up crews and plant and animal life in transport and restoration.

In terms of pollution, there's a lot of judgement that goes into this. "How clean is clean? ... Science toxicology can make connections between exposure and effects. We know low levels--sea otters--are getting continued exposure to oil." [then the paper says he said "but whether it's due to oil or others factors isn't clear"]. Dirty is never clean. And like chemicals in our households, oil clean-up chemicals make the environment less clean. Like household chemicals to children and pregnant women, oil response clean-up chemicals are dangerous, hazardous and devastating to even the strongest immune system as apparent from the lesions and internal bleeding displayed in the oil spill clean up worker community. I think cleanliness is a non-issue here because connections between exposure and effects on humans and animals favors an argument of a toxic, unclean scene.

Finally, I find the proposed changes too early considering new evidence of the intense and extensive lingering subsurface oil in intertidal areas of
western Prince William Sound (critical foraging areas for sea ducks and otters), coupled with toxicological evidence on the effects of chronic oil
pollution exposure to species and invertebrates that are dependent on intertidal habitats. There is an inconsistency between the scientific data on these resources and the proposed status upgrades.

Some monitored resources require down-listing status or "recovery unknown" reclassification, such as Intertidal Communities, Sea Otters, Clams,
Sediments, and Pacific Herring, until more studies are completed. Since much of the oiled sediments (surveyed last summer by the National Marine Fisheries Service) underlies productive nearshore habitats of the western Sound--home to mussels and clams and other intertidal life--the Intertidal Communities, their dependent predators and web of life, require more precautionary status such as "not recovered" or "recovery unknown".

I join Alaska Center for the Environment in requesting that Harlequin Ducks, Clams, Sea Otters--species and invertebrates dependent on
the productive lower and mid-intertidal habitats-- be recategorized as "Not Recovering". AB Pod Killer Whales, Pink Salmon, Black Oystercatchers
must remain classified as "Recovering", NOT recovered. Evidence on the toxicological effects of chronic oil pollution and lingering oil in the lower intertidal areas demonstrate the need for further monitoring and strict adherence to recovery standards established in 1984.

Thank you for the opportunity to share my comments and opinion.

Sincerely, Lauren Joy Padawer

Eyak Preservation Council
PO BOX 460
Cordova, Alaska 99574
v) 907.424.5890
f) 907.424.5891
www.redzone.org

Molly McCammon

From: Donna [ecofem2000@yahoo.com]
Sent: Friday, July 05, 2002 10:47 AM
To: molly_mccammon@oilspill.state.ak.us
Subject: Status of Recovery

Dear Members and Staff of the EVOS Trustee Council,

I appreciate the opportunity to weigh in on your proposed changes to the status of recovery of species injured from Exxon's oil spill.

I strongly request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. Harlequin Ducks, Herring, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower

and mid-intertidal habitats-- be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for all reclassification.

Public education about the status of species is an important responsibility of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

Thank you for the opportunity to comment.

Signed,
Donna Anderson
2212 Great Western, D
Douglas, Alaska 99824
907-364-2388

Molly McCammon

From: Deborah Mole [jtbrown@gci.net]
Sent: Friday, July 05, 2002 1:58 PM
To: mollymccammon@oilspill.state.ak.us
Subject: Comments

Hello Molly,

Firstly, I am writing to let you know that I would prefer that your organization err on the side of safety and protection when considering the "status" of habitat or species. These determinations should dpend upon independent, non-stakeholder reviews of studies, or independent and paralell studies by non-stakeholder and non-stakeholder associated entities. I think it is very important to consider the leverage that the stakeholders exert throughout the process, and re-balance to achieve justice for all.

I am concerned that so many of the council are employees of the State of Alaska, which recieves all of it's money from Oil Companies. Also that many have direct ties to Oil Companies. Why don't we have Environmental Engineers, and Scientists on the panel. Please excuse me if I am being presumptuous ofthe history or philisophical leanings of the board. I do however recognize that the money and power behind the oil companies is unparalelled worldwide. It seems to me that within an environment of this type it is imperative that we question our processes to determine the true stressors which bring about final decisions regarding important natural and human resources. This type of environment rewards people socially, economically, and vocationally when the wishes of the industry are complied with, no matter how "seemingly" innocuous. The "status" of a given species as determined by a state entity may hold great weight when considering damages in future and past litigation, regulatory policy, grants for protection, and public interest in specific habitat or regions. It is my sincerest wish that the "status" of species be determined through the most rigorous of processes. Any thing less is a service to those who would do needless harm for the sole/soul purpose of self enrichment.

Also, has anyone contacted your organization regarding Prince William Sound Keeper and the possibility of your organization providing funds for "Habitat Protection" in the sound. I find it a striking point that, not to detract from their importance, the only habitat protection implemented so far have been temporary conservation easements.

Thank you for your time,
J. Todd Brown

Molly McCammon

From: Carol Hoover [hooves@redzone.org]
Sent: Monday, July 08, 2002 6:29 AM
To: Molly McCammon
Cc: Dune Lankard
Subject: Re: Comment letter

Dear Molly:

Thank you so much for the personal reply.

It was very disconcerting when this past spring Dune went out on the Sound and the only beach he went on had oil just beneath the surface. We filmed there - it was really sad. Also - Riki is presenting some important "science" that I would recommend that the Trustee Council review. The effects of oil in sea water are much worse than previously thought, and the repercussions much longer lasting. The effects on salmon are multi-generational, with unhealthy embryo's for years being the result. With oil still on the beaches, still seeping into the food chain, much more research and indeed, restoration, needs to be done to allow us to make sane decisions about the effects of the oil and hydrocarbons we accidentally spill, as well as that which we indiscriminately distribute into pristine ecosystems (and the recovering once pristine ones).

Please do get in touch with us if there is anything we can do to assist in this process. We must work together to ensure the health of our region and all of its "civilized" and wild inhabitants.
Thank you.
Best regards,
Carol
--
Carol Hoover
Eyak Preservation Council
PO Box 460
Cordova, AK 99574
907 424 5890 v
907 424 5891 f
www.redzone.org

Molly McCammon wrote:

> Thanks Carol for your comments. No one has suggested harlequins, herring,
> clams or sea otters are recovered. I'm sorry if somehow you received
> incorrect information. The issue is where on the line between "not
> recovered" and some signs of "recovering" these species should be. I will be
> sure to pass on your comments to the Trustee Council. Sincerely, Molly
> McCammon
>
> -----Original Message-----
> From: Carol Hoover [mailto:hooves@redzone.org]
> Sent: Wednesday, July 03, 2002 12:53 PM
> To: molly_mccammon@oilspill.state.ak.us
> Subject: Comment letter
>
> Dear Molly:
>
> I have been working in Cordova since 1994 - and am friends and
> associates with many who love, work and do science in the Sound.
>
> It is NOT recovered. Many species that we know of, and many species
> sytems that are not listed may not be recovered. The Orcas are NOT -
> this is a fact. The

> Harlequin Ducks, Herring, Clams and Sea Otters are NOT - this is a fact.
> There is oil on the beaches still polluting the environement. There are
> no herring. The people of the area are still suffering economic,
> pshycological and physical trauma from the spill. That is a fact.
>
> The fact that the Council is even considereing giving these species and
> others in the Sound a recovered status is undeniably unsound, unwise,
> unfair and smacks of a strange sense of blind values. I feel that it
> will take courage to tell the truth in this situation and for some
> reason we are not aware of, there seems to be a push to declare theses
> species, and the Sound for that matter, as recovered.
>
> As I am sure you may know, we know now that it is only one part per
> billion of oil pollution in salt water that causes harm to the
> reproductive abilities of salmon and other wildlife - NOT one part per
> million as was thought at the time of the spill. What else will we find
> out in the future about the harm that this disasterous spill has caused?
>
> It is also imperative that the Trustee Council make determinations based
> on current peer-reviewed science and the Precautionary Principle when
> making recommendations for reclassifications. Public education about the
> status of species is an important responsibility
> of the Trustee Council, these recovery and lack-of-recovery findings
> must continue to be made available to the general public.
>
> Thank you.
> Best regards,
> Carol Hoover
>
> --
> Carol Hoover
> Eyak Preservation Council
> PO Box 460
> Cordova, AK 99574
> 907 424 5890 v
> 907 424 5891 f
> www.redzone.org

Molly McCammon

From: Udi Lazimy [ulazimy@hotmail.com]
Sent: Monday, July 08, 2002 4:45 PM
To: molly_mccammon@oilspill.state.ak.us
Subject: Recovery status comments

Dear Members and Staff of the EVOS Trustee Council,

I appreciate the opportunity to weigh in on your proposed changes to the status of recovery of species injured from Exxon's oil spill.
I strongly request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. Harlequin Ducks, Herring, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats-- be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications. Public education about the status of species is an important responsibility of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

Thank you for the opportunity to comment.

Signed,

Udi Lazimy
Wisconsin resident

Molly McCammon

From: dune lankard [dune@redzone.org]
Sent: Monday, July 08, 2002 1:55 AM
To: molly_mccammon@oilspill.state.ak.us
Cc: hooves@redzone.org; laurenjoy@redzone.org; ulazimy@hotmail.com; georgia_rodgers@hotmail.com
Subject: comment letter

July 8, 2002

Dear Molly:

We, here at the Eyak Preservation Council (EPC) hope all is well with you and the Trustee Council. I would like to take this time and comment on on your proposed changes to the status of recovery of species injured from Exxon's oil spill and the current status of Prince William Sound (Sound).

Many species are struggling to recover from the oil spill, I feel that it is premature to relist the status without indepth and personal discussions with the villages and residents of the Sound. There is traditional and cultural knowledge and perspectives about certain species and their current status of recovery that your science does not cover. I would suggest that you come down here to Cordova and hold a EVOSTC public hearing and hear for yourself from PWS citizens, with firsthand experience about the current state of the Sound and the wildlife.

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications. Public education about the status of species is an important responsibility of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

I strongly request that the AB Pod of Killer Whales remain classified as "Recovering." Changing the status of any of the Sound's wild and sealife is much too soon. Our ocean way of life here in the Sound is being treated like a political football that scientists and government continue to just throw around.

Please take the time to reevaluate your actions and pursue the $100 million re-opener and help us get our feet back on the ground. There is science that shows that oil is much more toxic than we thought. And, that there was much more oil spilled than Exxon or the Government is willing to admit too. Therefore, the effects are much worse and will last much longer than expected or stated.

We are witnessing a complete collapse of the environment, wild and sealife and our local fishing economy. Please rethink this critical relisting process. We must work together to ensure the health of our region and full recovery of our wild inhabitants of the Sound. Thank you for your time.

In Spirit of the Sound,
Dune

Dune Lankard
Eyak Preservation Council
PO Box 460

Cordova, AK 99574
907 424 5890 v
907 424 5891 f
www.redzone.org

Molly McCammon

From: Marybeth Holleman [nellie_juan@yahoo.com]
Sent: Monday, July 08, 2002 11:59 AM
To: molly_mccammon@oilspill.state.ak.us
Subject: comments on proposed species status changes

8 July 2002

Dear Members and Staff of the EVOS Trustee Council:

I appreciate the opportunity to comment on your proposed changes to the status of recovery of species injured from Exxon's oil spill.

First, I strongly request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. The pod has not yet returned to its pre-spill size, nor its pre-spill age/sex structure. Please follow the advice of the scientist who best knows the AB pod, Craig Matkin, and continue listing this pod as "Recovering."

Second, pink salmon should remain in the "Recovering" category since you can't document that they have recovered from all effects of the spill. I'm concerned that you changed the recovery objective for this species to one that you don't have and aren't collecting data for. Changing a recovery objective at this point in time undermines the entire process for which you are responsible.

Third, herring should be downgraded from "recovering" to "not recovering." As your own draft document states, their recovery has stalled--which means they are no longer recovering.

Fourth, harbor seals should be listed in a new category, "Declining." Their population continues its steep decline, and so warrants the creation of a new category which honestly reflects the population's status.

And finally, Harlequin Ducks, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats--should be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications.

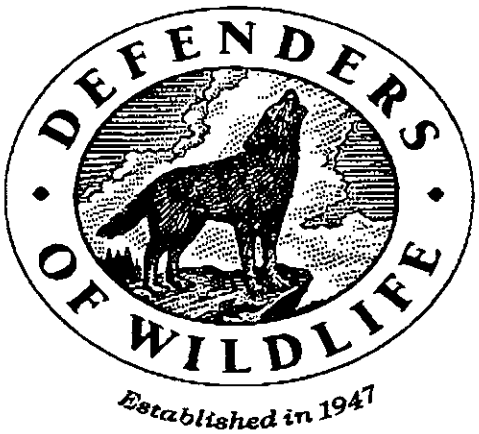
I urge you to consider the best available data and to make your decisions with extreme caution. As I am sure you are well aware, this is a ground-breaking process that the entire world is watching carefully.

Thank you for the opportunity to comment.

Sincerely,

Marybeth Holleman

A Quick Message From:



Jim Curland
Marine Program Associate
Defenders of Wildlife
P.O. Box 959
Moss Landing, CA. 95039
(831) 726-9010-telephone
(831) 726-9020-fax
jcurland@defenders.org

[redacted]

Monday, July 8, 2002

Number of Pages (Including cover sheet)-4

Please deliver ASAP to: **Molly McCammon**
Exxon Valdez Oil Spill Trustee Council

(907) 276-7178

Regarding: Official Public Comments-Draft Status of Injured Resources

Please find attached our comments.

Should you have trouble with this transmission, please contact me.

thanks,

Jim Curland

July 8, 2002

Exxon Valdez Oil Spill Trustee Council
441 W. 5th Avenue, Suite 500
Anchorage, AK 99501

Dear Members and Staff of the EVOS Trustee Council,

Defenders of Wildlife (Defenders), on behalf of over 450,000 members nationally and 1,500 in Alaska, appreciates the opportunity to submit comments on the proposed changes to the ***Draft Status of Injured Resources*** (Draft Status Report) which updates the status of species affected by the 1989 **Exxon Valdez** oil spill (EVOS). Defenders' is a leading nonprofit conservation organization recognized as one of the nation's most progressive advocates for wildlife and its habitat. Defenders' is dedicated to the protection of all native wild animals and plants in their natural communities. We focus our programs on what scientists consider two of the most serious environmental threats to the planet: the accelerating rate of extinction of species and the associated loss of biological diversity, and habitat alteration and destruction. Long known for our leadership on endangered species issues, we also advocate new approaches to wildlife conservation that will help keep species from becoming endangered. Our programs encourage protection of entire ecosystems and interconnected habitats while protecting predators that serve as indicator species for ecosystem health.

Out of the thirty species and habitat types, as recognized by the EVOS Trustee Council (Council) as having suffered effects from EVOS, it is our understanding that the Council is planning on changing the status of nine of these resources by changing their classification to "Recovered" or "Recovering". In our comments, we will focus on the reclassification of the northern sea otter (*Enhydra lutris kenyoni*) and the killer whale (*Orcinus orca*).

We strongly disagree with the Council's recommendation that the northern sea otter be reclassified as "Recovering". In the most recent marine mammal stock assessment report (SAR) for the northern sea otter found in Alaska, U.S. Fish and Wildlife Service (FWS) concluded, "at present, abundance of sea otters in some oiled areas of Prince William Sound remains below pre-spill estimates, and evidence from ongoing studies suggests that sea otters and the nearshore ecosystem have not yet fully recovered from the 1989 oil spill (Bodkin et al., in press, Stephensen et al. 2001). Other areas outside of Prince William Sound that were affected by the spill have not been intensively

National Headquarters
1101 Fourteenth Street, N.W.
Suite 1400
Washington, D.C. 20005
Telephone: 202-682-9400
Fax: 202-682-1331
www.defenders.org
www.kidsplanet.org

studied for long-term impacts"[1]. In addition, the SAR reports that the vulnerability of sea otters to oiling from EVOS was demonstrated by the total estimates of mortality for the Prince William Sound area that varies from 750 (range 600-1,000; Garshelis 1997) to 2,650 (range 500 - 5,000; Garrot et al. 1993). Statewide, it is estimated that 3,905 sea otters (range 1,904 - 11,257) died in Alaska because of the spill (DeGange et al. 1994).

The Draft Status Report points out the Council's Nearshore Vertebrate Predator project that addressed the lack of recovery in sea otters in the heavily oiled bays of western Prince William Sound. In the report, it is stated that, "the lack of recovery may reflect the extended time required for population growth for a long-lived mammal with a low reproductive rate, but it also could reflect the effects of continuing exposure to hydrocarbons or a combination of both factors. An extremely cautious approach must be used in assessing the status of sea otters found within the oiled areas. Declines in the southwest stock of sea otters are unprecedented and the cause is yet to be fully determined. Further monitoring of these areas and the sea otter population must continue to accurately determine their status. It is premature and without any scientific evidence for the Draft Status Report to conclude that, "it is clear that sea otter recovery is underway for much of the spill-area, with the exception of populations at the most heavily oiled bays in western Prince William Sound. For this reason, sea otters continue to be in the recovering category."

The AB Pod of resident killer whales in Prince William Sound was severely impacted by the EVOS. Prior to 1989, there were approximately 36 whales in this pod. The AB pod of Killer Whales, the most commonly seen killer whales prior to and during the oil spill, has experienced a 27 percent decline in population since 1989 and is still ten individuals short of it's pre-oil spill population. According to killer whale researcher Craig Matkin, "considering their low birth rate and high mortality rate for calves, it will be a long-time, if ever, before the AB pod reaches its pre-spill size and can be considered "recovered"". Researchers believe that the most likely cause of the high mortality in the AB Pod was a result of inhalation of petroleum vapors. Exposure to oil can cause both immediate mortalities and subsequent deaths due to pneumonia or other disorders.

The AB pod has failed to show signs of recovery to its pre-spill size of 36. The AB pod must remain classified as "recovering", NOT "recovered".

In addition, we urge the Council to reclassify Harlequin Ducks, Herring, Clams --species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats-- as "Not Recovering" or "Recovery Unknown". This reclassification should equally apply to Intertidal Communities and Sediments until more studies are completed. Since much of the oiled sediments (surveyed last summer by the National Marine Fisheries Service) underlies productive nearshore habitats of the western Sound--home to mussels and clams and other intertidal life--the Intertidal Communities, their dependent predators and web of life, require more precautionary status.

---

[1] Draft Revised Marine Mammal Stock Assessment Report for the Northern Sea Otter. Revised February 13, 2002. U.S. Fish and Wildlife Service, Marine Mammals Management. Anchorage, Alaska.

A precautionary approach to recovery status is needed. These proposed changes are rash, considering new evidence of the intense and extensive lingering subsurface oil in intertidal areas of western Prince William Sound. These are critical foraging areas for many species, and toxicological evidence indicates effects of chronic oil pollution exposure to species and invertebrates that are dependent on these intertidal habitats.

There is an inconsistency between the scientific data presented in the Draft Status Report and that which exists in the peer-reviewed science relating to EVOS and its affect on the marine life and habitats. These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Council make determinations based on best available science and that the Precautionary Principle is applied when making recommendations for reclassifications. Public education about the status of species is an important responsibility of the Council, and these resource status updates must continue to be made available to the public.

Thank you for the opportunity to comment. Should you have any questions, please contact Jim Curland, Marine Program Associate, at (831) 726-9010 or through email at jcurland@defenders.org or Karen Deatherage, Alaska Program Associate, at (907) 276-9453 or through email at kdeatherage@defenders.org.

Sincerely,

Jim Curland
Marine Program Associate

Karen Deatherage
Alaska Program Associate

Cc: Rosa Meehan (**U.S. Fish and Wildlife Service**)
Jim Bodkin (**U.S. Geological Survey**)
Michelle Wilson (**Alaska Center for the Environment**)
Don Baur, esq.
Don Mooney, esq.

Paula Banks

From: Molly McCammon [molly_mccammon@oilspill.state.ak.us]
Sent: Wednesday, July 03, 2002 3:40 PM
To: Paula Banks
Subject: FW: official public comments

Copy for distribution to TC on Tuesday.

-----Original Message-----
From: scott metzger [mailto:slm@adnmail.com]
Sent: Wednesday, July 03, 2002 3:30 PM
To: molly_mccammon@oilspill.state.ak.us
Subject: official public comments

EVOS Trustees Council, July, 3,2002

The following are my official public comments regarding the recovery status of the 9 species up for reconsideration by the Council. This is in regards to the 25 species injured by the Exxon Valdez Oil Spill.

First of all it is my opinion that the only factor that should affect whether a species is listed as "not recovered", "recovering", or "recovered" should be solid scientific evidence. This should not be a politically motivated decision making process and if there is not enough evidence to support a "recovered" listing, then no species should be listed as "recovered".

In the instances where there is not enough scientific iformation gathered or the studies remain inconclusive, the most scientifically sound thing to do would be to list those species as "recovery unkown" or "not recovered."

The AB Pod of Killer Whales has shown a low birth rate, high calf mortality, and is still 10 whales short of the pre spill population size. Based on these facts the AB pod should remain classified as "RECOVERING", or "NOT RECOVERED".

Based on new studies completed in 2001 by NOAA, there is evidence that oil still exists on most of the heavily oiled beaches in PWS. The affects of this lingering oil on intertidal invertebrates is still completely unknown. Therefore it is premature to classify

Clams, herring, Harlequin ducks, and sea otters as anything but "RECOVERY UNKNOWN", or "NOT RECOVERING". All of these species rely on intertidal areas for foraging and reproduction. These species cannot be recovered when the lingering affects of this oil remain unstudied.

Thank you , Sincerely, Scott Metzger

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"A free and open media is necessary in order for a people to be free"

Molly McCammon

From: Deborah Mole [jtbrown@gci.net]
Sent: Friday, July 05, 2002 1:58 PM
To: mollymccammon@oilspill.state.ak.us
Subject: Comments

Hello Molly,

Firstly, I am writing to let you know that I would prefer that your organization err on the side of safety and protection when considering the "status" of habitat or species. These determinations should dpend upon independent, non-stakeholder reviews of studies, or independent and paralell studies by non-stakeholder and non-stakeholder associated entities. I think it is very important to consider the leverage that the stakeholders exert throughout the process, and re-balance to achieve justice for all.

I am concerned that so many of the council are employees of the State of Alaska, which recieves all of it's money from Oil Companies. Also that many have direct ties to Oil Companies. Why don't we have Environmental Engineers, and Scientists on the panel. Please excuse me if I am being presumptuous ofthe history or philisophical leanings of the board. I do however recognize that the money and power behind the oil companies is unparalelled worldwide. It seems to me that within an environment of this type it is imperative that we question our processes to determine the true stressors which bring about final decisions regarding important natural and human resources. This type of environment rewards people socially, economically, and vocationally when the wishes of the industry are complied with, no matter how "seemingly" innocuous. The "status" of a given species as determined by a state entity may hold great weight when considering damages in future and past litigation, regulatory policy, grants for protection, and public interest in specific habitat or regions. It is my sincerest wish that the "status" of species be determined through the most rigorous of processes. Any thing less is a service to those who would do needless harm for the sole/soul purpose of self enrichment.

Also, has anyone contacted your organization regarding Prince William Sound Keeper and the possibility of your organization providing funds for "Habitat Protection" in the sound. I find it a striking point that, not to detract from their importance, the only habitat protection implemented so far have been temporary conservation easements.

Thank you for your time,
J. Todd Brown

Molly McCammon

From: Carol Hoover [hooves@redzone.org]
Sent: Wednesday, July 03, 2002 12:53 PM
To: molly_mccammon@oilspill.state.ak.us
Subject: Comment letter

Dear Molly:

I have been working in Cordova since 1994 - and am friends and associates with many who love, work and do science in the Sound.

It is NOT recovered. Many species that we know of, and many species sytems that are not listed may not be recovered. The Orcas are NOT - this is a fact. The
Harlequin Ducks, Herring, Clams and Sea Otters are NOT - this is a fact. There is oil on the beaches still polluting the environement. There are no herring. The people of the area are still suffering economic, pshycological and physical trauma from the spill. That is a fact.

The fact that the Council is even considereing giving these species and others in the Sound a recovered status is undeniably unsound, unwise, unfair and smacks of a strange sense of blind values. I feel that it will take courage to tell the truth in this situation and for some reason we are not aware of, there seems to be a push to declare theses species, and the Sound for that matter, as recovered.

As I am sure you may know, we know now that it is only one part per billion of oil pollution in salt water that causes harm to the reproductive abilities of salmon and other wildlife - NOT one part per million as was thought at the time of the spill. What else will we find out in the future about the harm that this disasterous spill has caused?

It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications. Public education about the status of species is an important responsibility
of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

Thank you.
Best regards,
Carol Hoover

--
Carol Hoover
Eyak Preservation Council
PO Box 460
Cordova, AK 99574
907 424 5890 v
907 424 5891 f
www.redzone.org

Molly McCammon

From: Leo & Dorothy Keeler [info@akwildlife.com]
Sent: Wednesday, July 03, 2002 9:29 PM
To: molly_mccammon@oilspill.state.ak.us
Subject: Draft Update to Injured Resources

Dear Members and Staff of the EVOS Trustee Council,

I appreciate the opportunity to address your proposed changes to the status of recovery of species injured from Exxon's oil spill.

I emphatically request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. Harlequin Ducks, Herring, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats-- be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications.

Public education about the status of species is an important responsibility of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

Thank you for the opportunity to comment.

Signed,

Dorothy Keeler

Wilderness Inspirations™
P.O. Box 190647
Anchorage, Alaska 99519
(907)248-9916
fax(907)248-8589

Molly McCammon

From: Donna [ecofem2000@yahoo.com]
Sent: Friday, July 05, 2002 10:47 AM
To: molly_mccammon@oilspill.state.ak.us
Subject: Status of Recovery

Dear Members and Staff of the EVOS Trustee Council,

I appreciate the opportunity to weigh in on your proposed changes to the status of recovery of species injured from Exxon's oil spill.

I strongly request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. Harlequin Ducks, Herring, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower

and mid-intertidal habitats-- be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for all reclassification.

Public education about the status of species is an important responsibility of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

Thank you for the opportunity to comment.

Signed,
Donna Anderson
2212 Great Western, D
Douglas, Alaska 99824
907-364-2388

Molly McCammon

From: Lauren Joy Padawer [laurenjoy@redzone.org]
Sent: Thursday, July 04, 2002 4:06 AM
To: molly_mccammon@oilspill.state.ak.us
Subject: Exxon Valdez Oil Spill Trustee Council public comment

Dear Ms. Molly McCammon-

In regards to your recent debate about the contention between policy and scientific questions, I offer the following opinions as a citizen, an ecologist, and as a public interest activist.

When the Council has "no new evidence", should a species or resource not be moved to the 'recovery' line? I believe that EVOS needs to use language that is clearly understood for use with the public in media and reports. It is highly confusing to call a species 'recovered' when the science is NOT 100% conclusive. As long as population numbers are not recovered to prespill conditions, it is unacceptable and misleading to label them as 'recovered'. This I perceive as a tool conceived by oil corporate-funded politicians and Trustee Council members to usurp the truth from scientists and community members in the Sound who have seen continuing devastation to animals and habitat.

We're hearing a lot about the listing being a "public education tool" from the oil spill (not including global warming, tourism and other issues). When we list a species as recovered, the public thinks that means the species is healthy overall, how can we address this? It is clear that in ALL cases, the public needs to understand that the oil is NOT cleaned up, that it is impossible to clean up oil spills, and that oil is extremely toxic as water-soluble fractions (WSF's) and extremely hazardous as polycyclic aromatic hydrocarbons (PAH's), whether from spilled oil OR carbon emissions to humans, aquatic and terrestrial plant and animal life.

"We know there is still oil in the environment-large amount-could be there over 100 years, or longer. We know all these species at some stage of their life cycle will encounter this. Does that prohibit recovery? Some are looking for zero tolerance oil exposure. How can we address this issue?" I believe the environment has an incredible power to recover itself from human accidents and thoughtless destruction. However, the timeline for this kind of renewal takes anywhere from 10-800 years depending on the amount and type of degradation. Clearly, the amount of oil spilled in the Sound in 1989 is astounding and much larger than Exxon claimed in public press - almost 38 million gallons I understand is a closer calculation. I am not looking for 'zero-tolerance' as you put it, but rather an acceptance that this oil spill has left indelible psychological and abiding physical marks on the Sound ecosystem. As long as numbers are below pre-spill levels, the oil will remain a toxin in the Sound ecosystem. If after 100 years there are still species that have not reached pre-spill numbers, the EVOS Trustee Council will still be unable to call those species or the ecosystem recovered.

Craig Tillery commented that perhaps they could use the 'recovery unknown' catergory or more precise labeling that would maintain their credibility in the scientific community as well as to provide pubic education. I think this is very appropriate.

Bob Spies, chief scientist, asked "how precautionary should we be? Trustee council risks some credibility if it goes too far towards an extreme conservation definition." Conservation is preserving what has not yet lost integrity. Unfortunately, the Sound ecosystem has lost its pristine integrity forever. While problems are not apparent on the surface, they are exceedingly apparent under the microscope. This camera-view perspective has been a prevalent problem over the last 13 years and a problem which Exxon Corporation has capitalized on. Wherever possible, Exxon Corporation has portrayed a recovered version of the Sound. How can this be when our science clearly shows the contrary? It wouldn't be the case if money did not equal media angle.

So, to be precautionary, would be to honor the damage by continuing studies and distilling already published information about ecological damage in the Sound. It will prove time and again that oil is a hazardous substance dangerous to the

world in the form of emissions, risky to transport in our shared oceans, and toxic to oil industry workers, clean-up crews and plant and animal life in transport and restoration.

In terms of pollution, there's a lot of judgement that goes into this. "How clean is clean? ... Science toxicology can make connections between exposure and effects. We know low levels--sea otters--are getting continued exposure to oil." [then the paper says he said "but whether it's due to oil or others factors isn't clear"]. Dirty is never clean. And like chemicals in our households, oil clean-up chemicals make the environment less clean. Like household chemicals to children and pregnant women, oil response clean-up chemicals are dangerous, hazardous and devastating to even the strongest immune system as apparent from the lesions and internal bleeding displayed in the oil spill clean up worker community. I think cleanliness is a non-issue here because connections between exposure and effects on humans and animals favors an argument of a toxic, unclean scene.

Finally, I find the proposed changes too early considering new evidence of the intense and extensive lingering subsurface oil in intertidal areas of
western Prince William Sound (critical foraging areas for sea ducks and otters), coupled with toxicological evidence on the effects of chronic oil
pollution exposure to species and invertebrates that are dependent on intertidal habitats. There is an inconsistency between the scientific data on these resources and the proposed status upgrades.

Some monitored resources require down-listing status or "recovery unknown" reclassification, such as Intertidal Communities, Sea Otters, Clams,
Sediments, and Pacific Herring, until more studies are completed. Since much of the oiled sediments (surveyed last summer by the National Marine Fisheries Service) underlies productive nearshore habitats of the western Sound--home to mussels and clams and other intertidal life--the Intertidal Communities, their dependent predators and web of life, require more precautionary status such as "not recovered" or "recovery unknown".

I join Alaska Center for the Environment in requesting that Harlequin Ducks, Clams, Sea Otters--species and invertebrates dependent on
the productive lower and mid-intertidal habitats-- be recategorized as "Not Recovering". AB Pod Killer Whales, Pink Salmon, Black Oystercatchers
must remain classified as "Recovering", NOT recovered. Evidence on the toxicological effects of chronic oil pollution and lingering oil in the lower intertidal areas demonstrate the need for further monitoring and strict adherence to recovery standards established in 1984.

Thank you for the opportunity to share my comments and opinion.

Sincerely, Lauren Joy Padawer

Eyak Preservation Council
PO BOX 460
Cordova, Alaska 99574
v) 907.424.5890
f) 907.424.5891
www.redzone.org

Molly McCammon

From: Carol Hoover [hooves@redzone.org]
Sent: Monday, July 08, 2002 6:29 AM
To: Molly McCammon
Cc: Dune Lankard
Subject: Re: Comment letter

Dear Molly:

Thank you so much for the personal reply.

It was very disconcerting when this past spring Dune went out on the Sound and the only beach he went on had oil just beneath the surface. We filmed there - it was really sad. Also - Riki is presenting some important "science" that I would recommend that the Trustee Council review. The effects of oil in sea water are much worse than previously thought, and the repercussions much longer lasting. The effects on salmon are multi-generational, with unhealthy embryo's for years being the result. With oil still on the beaches, still seeping into the food chain, much more research and indeed, restoration, needs to be done to allow us to make sane decisions about the effects of the oil and hydrocarbons we accidentally spill, as well as that which we indiscriminately distribute into pristine ecosystems (and the recovering once pristine ones).

Please do get in touch with us if there is anything we can do to assist in this process. We must work together to ensure the health of our region and all of its "civilized" and wild inhabitants.
Thank you.
Best regards,
Carol
--
Carol Hoover
Eyak Preservation Council
PO Box 460
Cordova, AK 99574
907 424 5890 v
907 424 5891 f
www.redzone.org

Molly McCammon wrote:

> Thanks Carol for your comments. No one has suggested harlequins, herring,
> clams or sea otters are recovered. I'm sorry if somehow you received
> incorrect information. The issue is where on the line between "not
> recovered" and some signs of "recovering" these species should be. I will be
> sure to pass on your comments to the Trustee Council. Sincerely, Molly
> McCammon
>
> -----Original Message-----
> From: Carol Hoover [mailto:hooves@redzone.org]
> Sent: Wednesday, July 03, 2002 12:53 PM
> To: molly_mccammon@oilspill.state.ak.us
> Subject: Comment letter
>
> Dear Molly:
>
> I have been working in Cordova since 1994 - and am friends and
> associates with many who love, work and do science in the Sound.
>
> It is NOT recovered. Many species that we know of, and many species
> sytems that are not listed may not be recovered. The Orcas are NOT -
> this is a fact. The

> Harlequin Ducks, Herring, Clams and Sea Otters are NOT - this is a fact.
> There is oil on the beaches still polluting the environement. There are
> no herring. The people of the area are still suffering economic,
> pshycological and physical trauma from the spill. That is a fact.
>
> The fact that the Council is even considereing giving these species and
> others in the Sound a recovered status is undeniably unsound, unwise,
> unfair and smacks of a strange sense of blind values. I feel that it
> will take courage to tell the truth in this situation and for some
> reason we are not aware of, there seems to be a push to declare theses
> species, and the Sound for that matter, as recovered.
>
> As I am sure you may know, we know now that it is only one part per
> billion of oil pollution in salt water that causes harm to the
> reproductive abilities of salmon and other wildlife - NOT one part per
> million as was thought at the time of the spill. What else will we find
> out in the future about the harm that this disasterous spill has caused?
>
> It is also imperative that the Trustee Council make determinations based
> on current peer-reviewed science and the Precautionary Principle when
> making recommendations for reclassifications. Public education about the
> status of species is an important responsibility
> of the Trustee Council, these recovery and lack-of-recovery findings
> must continue to be made available to the general public.
>
> Thank you.
> Best regards,
> Carol Hoover
>
> --
> Carol Hoover
> Eyak Preservation Council
> PO Box 460
> Cordova, AK 99574
> 907 424 5890 v
> 907 424 5891 f
> www.redzone.org

Molly McCammon

From: Marybeth Holleman [nellie_juan@yahoo.com]
Sent: Monday, July 08, 2002 11:59 AM
To: molly_mccammon@oilspill.state.ak.us
Subject: comments on proposed species status changes

8 July 2002

Dear Members and Staff of the EVOS Trustee Council:

I appreciate the opportunity to comment on your proposed changes to the status of recovery of species injured from Exxon's oil spill.

First, I strongly request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. The pod has not yet returned to its pre-spill size, nor its pre-spill age/sex structure. Please follow the advice of the scientist who best knows the AB pod, Craig Matkin, and continue listing this pod as "Recovering."

Second, pink salmon should remain in the "Recovering" category since you can't document that they have recovered from all effects of the spill. I'm concerned that you changed the recovery objective for this species to one that you don't have and aren't collecting data for. Changing a recovery objective at this point in time undermines the entire process for which you are responsible.

Third, herring should be downgraded from "recovering" to "not recovering." As your own draft document states, their recovery has stalled--which means they are no longer recovering.

Fourth, harbor seals should be listed in a new category, "Declining." Their population continues its steep decline, and so warrants the creation of a new category which honestly reflects the population's status.

And finally, Harlequin Ducks, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats--should be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications.

I urge you to consider the best available data and to make your decisions with extreme caution. As I am sure you are well aware, this is a ground-breaking process that the entire world is watching carefully.

Thank you for the opportunity to comment.

Sincerely,

Marybeth Holleman

Molly McCammon

From: scott metzger [slm@adnmail.com]
Sent: Wednesday, July 03, 2002 3:30 PM
To: molly_mccammon@oilspill.state.ak.us
Subject: official public comments

EVOS Trustees Council, July, 3,2002

The following are my official public comments regarding the recovery status of the 9 species up for reconsideration by the Council. This is in regards to the 25 species injured by the Exxon Valdez Oil Spill.

First of all it is my opinion that the only factor that should affect whether a species is listed as "not recovered", "recovering", or "recovered" should be solid scientific evidence. This should not be a politically motivated decision making process and if there is not enough evidence to support a "recovered" listing, then no species should be listed as "recovered".

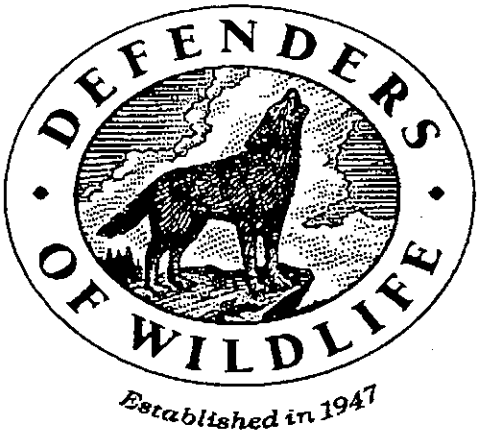
In the instances where there is not enough scientific iformation gathered or the studies remain inconclusive, the most scientifically sound thing to do would be to list those species as "recovery unkown" or "not recovered."

The AB Pod of Killer Whales has shown a low birth rate, high calf mortality, and is still 10 whales short of the pre spill population size. Based on these facts the AB pod should remain classified as "RECOVERING", or "NOT RECOVERED".

Based on new studies completed in 2001 by NOAA, there is evidence that oil still exists on most of the heavily oiled beaches in PWS. The affects of this lingering oil on intertidal invertebrates is still completely unknown. Therefore it is premature to classify Clams, herring, Harlequin ducks, and sea otters as anything but "RECOVERY UNKNOWN", or "NOT RECOVERING". All of these species rely on intertidal areas for foraging and reproduction. These species cannot be recovered when the lingering affects of this oil remain unstudied.

Thank you , Sincerely, Scott Metzger

A Quick Message From:



Jim Curland
Marine Program Associate
Defenders of Wildlife
P.O. Box 959
Moss Landing, CA. 95039
(831) 726-9010-telephone
(831) 726-9020-fax
jcurland@defenders.org

[redacted]

Monday, July 8, 2002

Number of Pages (Including cover sheet)-4

Please deliver ASAP to: **Molly McCammon**
Exxon Valdez Oil Spill Trustee Council

(907) 276-7178

Regarding: Official Public Comments-Draft Status of Injured Resources

Please find attached our comments.

Should you have trouble with this transmission, please contact me.

thanks,

Jim Curland

July 8, 2002

Exxon Valdez Oil Spill Trustee Council
441 W. 5th Avenue, Suite 500
Anchorage, AK 99501

Dear Members and Staff of the EVOS Trustee Council,

Defenders of Wildlife (Defenders), on behalf of over 450,000 members nationally and 1,500 in Alaska, appreciates the opportunity to submit comments on the proposed changes to the ***Draft Status of Injured Resources*** (Draft Status Report) which updates the status of species affected by the 1989 **Exxon Valdez** oil spill (EVOS). Defenders' is a leading nonprofit conservation organization recognized as one of the nation's most progressive advocates for wildlife and its habitat. Defenders' is dedicated to the protection of all native wild animals and plants in their natural communities. We focus our programs on what scientists consider two of the most serious environmental threats to the planet: the accelerating rate of extinction of species and the associated loss of biological diversity, and habitat alteration and destruction. Long known for our leadership on endangered species issues, we also advocate new approaches to wildlife conservation that will help keep species from becoming endangered. Our programs encourage protection of entire ecosystems and interconnected habitats while protecting predators that serve as indicator species for ecosystem health.

Out of the thirty species and habitat types, as recognized by the EVOS Trustee Council (Council) as having suffered effects from EVOS, it is our understanding that the Council is planning on changing the status of nine of these resources by changing their classification to "Recovered" or "Recovering". In our comments, we will focus on the reclassification of the northern sea otter (*Enhydra lutris kenyoni*) and the killer whale (*Orcinus orca*).

We strongly disagree with the Council's recommendation that the northern sea otter be reclassified as "Recovering". In the most recent marine mammal stock assessment report (SAR) for the northern sea otter found in Alaska, U.S. Fish and Wildlife Service (FWS) concluded, "at present, abundance of sea otters in some oiled areas of Prince William Sound remains below pre-spill estimates, and evidence from ongoing studies suggests that sea otters and the nearshore ecosystem have not yet fully recovered from the 1989 oil spill (Bodkin et al., in press, Stephensen et al. 2001). Other areas outside of Prince William Sound that were affected by the spill have not been intensively

National Headquarters
1101 Fourteenth Street, N.W.
Suite 1400
Washington, D.C. 20005
Telephone: 202-682-9400
Fax: 202-682-1331
www.defenders.org
www.kidsplanet.org

studied for long-term impacts"[1]. In addition, the SAR reports that the vulnerability of sea otters to oiling from EVOS was demonstrated by the total estimates of mortality for the Prince William Sound area that varies from 750 (range 600-1,000; Garshelis 1997) to 2,650 (range 500 - 5,000; Garrot et al. 1993). Statewide, it is estimated that 3,905 sea otters (range 1,904 - 11,257) died in Alaska because of the spill (DeGange et al. 1994).

The Draft Status Report points out the Council's Nearshore Vertebrate Predator project that addressed the lack of recovery in sea otters in the heavily oiled bays of western Prince William Sound. In the report, it is stated that, "the lack of recovery may reflect the extended time required for population growth for a long-lived mammal with a low reproductive rate, but it also could reflect the effects of continuing exposure to hydrocarbons or a combination of both factors. An extremely cautious approach must be used in assessing the status of sea otters found within the oiled areas. Declines in the southwest stock of sea otters are unprecedented and the cause is yet to be fully determined. Further monitoring of these areas and the sea otter population must continue to accurately determine their status. It is premature and without any scientific evidence for the Draft Status Report to conclude that, "it is clear that sea otter recovery is underway for much of the spill-area, with the exception of populations at the most heavily oiled bays in western Prince William Sound. For this reason, sea otters continue to be in the recovering category."

The AB Pod of resident killer whales in Prince William Sound was severely impacted by the EVOS. Prior to 1989, there were approximately 36 whales in this pod. The AB pod of Killer Whales, the most commonly seen killer whales prior to and during the oil spill, has experienced a 27 percent decline in population since 1989 and is still ten individuals short of it's pre-oil spill population. According to killer whale researcher Craig Matkin, "considering their low birth rate and high mortality rate for calves, it will be a long-time, if ever, before the AB pod reaches its pre-spill size and can be considered "recovered"". Researchers believe that the most likely cause of the high mortality in the AB Pod was a result of inhalation of petroleum vapors. Exposure to oil can cause both immediate mortalities and subsequent deaths due to pneumonia or other disorders.

The AB pod has failed to show signs of recovery to its pre-spill size of 36. The AB pod must remain classified as "recovering", NOT "recovered".

In addition, we urge the Council to reclassify Harlequin Ducks, Herring, Clams --species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats-- as "Not Recovering" or "Recovery Unknown". This reclassification should equally apply to Intertidal Communities and Sediments until more studies are completed. Since much of the oiled sediments (surveyed last summer by the National Marine Fisheries Service) underlies productive nearshore habitats of the western Sound--home to mussels and clams and other intertidal life--the Intertidal Communities, their dependent predators and web of life, require more precautionary status.

---

[1] Draft Revised Marine Mammal Stock Assessment Report for the Northern Sea Otter. Revised February 13, 2002. U.S. Fish and Wildlife Service, Marine Mammals Management. Anchorage, Alaska.

A precautionary approach to recovery status is needed. These proposed changes are rash, considering new evidence of the intense and extensive lingering subsurface oil in intertidal areas of western Prince William Sound. These are critical foraging areas for many species, and toxicological evidence indicates effects of chronic oil pollution exposure to species and invertebrates that are dependent on these intertidal habitats.

There is an inconsistency between the scientific data presented in the Draft Status Report and that which exists in the peer-reviewed science relating to EVOS and its affect on the marine life and habitats. These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Council make determinations based on best available science and that the Precautionary Principle is applied when making recommendations for reclassifications. Public education about the status of species is an important responsibility of the Council, and these resource status updates must continue to be made available to the public.

Thank you for the opportunity to comment. Should you have any questions, please contact Jim Curland, Marine Program Associate, at (831) 726-9010 or through email at jcurland@defenders.org or Karen Deatherage, Alaska Program Associate, at (907) 276-9453 or through email at kdeatherage@defenders.org.

Sincerely,

Jim Curland

Karen Deatherage

Jim Curland
Marine Program Associate

Karen Deatherage
Alaska Program Associate

Cc: Rosa Meehan (**U.S. Fish and Wildlife Service**)
Jim Bodkin (**U.S. Geological Survey**)
Michelle Wilson (**Alaska Center for the Environment**)
Don Baur, esq.
Don Mooney, esq.

July 3, 2002

Exxon Valdez Oil Spill Trustee Council
441 W. 5th Avenue, Suite 500
Anchorage, AK 99501-2340

Dear Members and Staff of the EVOS Trustee Council:

I appreciate the opportunity to weigh in on your proposed changes to the status of recovery of species injured from Exxon's oil spill.

I strongly request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. Harlequin Ducks, Herring, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats-- be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications. Public education about the status of species is an important responsibility of the Trustee Council and these recovery and lack of recovery findings must continue to be made available to the general public.

Thank you for the opportunity to comment.

Sincerely,

Maryellen Oman

Maryellen Oman
12951 Summer Circle
Anchorage, AK 99516-2629

Molly McCammon

From: Udi Lazimy [ulazimy@hotmail.com]
Sent: Monday, July 08, 2002 4:45 PM
To: molly_mccammon@oilspill.state.ak.us
Subject: Recovery status comments

Dear Members and Staff of the EVOS Trustee Council,

I appreciate the opportunity to weigh in on your proposed changes to the status of recovery of species injured from Exxon's oil spill.
I strongly request that the AB Pod of Killer Whales remain classified as "Recovering", NOT recovered. Harlequin Ducks, Herring, Clams, Sea Otters--species and invertebrates dependent on non-contaminated, lower and mid-intertidal habitats-- be recategorized as "Not Recovering".

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications. Public education about the status of species is an important responsibility of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

Thank you for the opportunity to comment.

Signed,

Udi Lazimy
Wisconsin resident

Molly McCammon

From: dune lankard [dune@redzone.org]
Sent: Monday, July 08, 2002 1:55 AM
To: molly_mccammon@oilspill.state.ak.us
Cc: hooves@redzone.org; laurenjoy@redzone.org; ulazimy@hotmail.com; georgia_rodgers@hotmail.com
Subject: comment letter

July 8, 2002

Dear Molly:

We, here at the Eyak Preservation Council (EPC) hope all is well with you and the Trustee Council. I would like to take this time and comment on on your proposed changes to the status of recovery of species injured from Exxon's oil spill and the current status of Prince William Sound (Sound).

Many species are struggling to recover from the oil spill, I feel that it is premature to relist the status without indepth and personal discussions with the villages and residents of the Sound. There is traditional and cultural knowledge and perspectives about certain species and their current status of recovery that your science does not cover. I would suggest that you come down here to Cordova and hold a EVOSTC public hearing and hear for yourself from PWS citizens, with firsthand experience about the current state of the Sound and the wildlife.

These decisions must take into consideration the injuries unanticipated at the time of settlement with Exxon. It is also imperative that the Trustee Council make determinations based on current peer-reviewed science and the Precautionary Principle when making recommendations for reclassifications. Public education about the status of species is an important responsibility of the Trustee Council, these recovery and lack-of-recovery findings must continue to be made available to the general public.

I strongly request that the AB Pod of Killer Whales remain classified as "Recovering." Changing the status of any of the Sound's wild and sealife is much too soon. Our ocean way of life here in the Sound is being treated like a political football that scientists and government continue to just throw around.

Please take the time to reevaluate your actions and pursue the $100 million re-opener and help us get our feet back on the ground. There is science that shows that oil is much more toxic than we thought. And, that there was much more oil spilled than Exxon or the Government is willing to admit too. Therefore, the effects are much worse and will last much longer than expected or stated.

We are witnessing a complete collapse of the environment, wild and sealife and our local fishing economy. Please rethink this critical relisting process. We must work together to ensure the health of our region and full recovery of our wild inhabitants of the Sound. Thank you for your time.

In Spirit of the Sound,
Dune

Dune Lankard
Eyak Preservation Council
PO Box 460

Cordova, AK 99574
907 424 5890 v
907 424 5891 f
www.redzone.org