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Natural Resources
Defense Council

1350 New York Ave., N.W.
Washington, DC 20005
202 783-7800
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September 14, 1989

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Commissioner
Alaska Department of Fish and Game
P.O. Box 3-2000
Juneau, Alaska 99802

re: Request for Extension of Time to Comment on State/Federal Natural Resource Damage Assessment Plan for the Exxon Valdez Oil Spill

Dear Trustee Council:

This letter is filed on behalf of the Natural Resources Defense Council, the National Audubon Society, Trustees for Alaska, the Sierra Club Legal Defense Fund, the Wilderness Society, Defenders of Wildlife, the Environmental Defense Fund, and the National Wildlife Federation. These groups represent a combined membership of millions of Americans who are concerned about the adequacy of the damage assessment and restoration plans for the Exxon Valdez oil spill.

We hereby request a three-week extension of the deadline for filing comments on the State/Federal Natural Resource Damage Assessment Plan for the Exxon Valdez Oil Spill (August 1989 Public Review Draft) ("Draft Plan"). Under this extension, comments would be received on or before October 23, 1989.[1]

Com.	Topic	Issue	Sug.	Sort
1	4	0204		1

[1] Three weeks from September 30, 1989 falls on a Saturday. October 23, 1989 is the next business day,

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This extension is justified for a number of reasons. First, because the plan was printed and released in Juneau, and because the small initial supply that was shipped to Washington, D.C. was depleted within one day, it took as long as one week for many of our groups to obtain copies of the Draft Plan. In addition, we distributed copies of the plan to a number of additional reviewers around the country, many of whom did not receive their copies until as much as two weeks after the plan was released.

The Draft Plan covers a wide range of disciplines, and proposes a large number of studies that require detailed review by scientific and economic experts. In order to provide meaningful, constructive comments on the draft plan, we are working with experts all over the country. Coordinating these reviews and combining them into useful comments cannot be accomplished by the September 30, 1989 deadline.

In addition, all of the signatory groups are working together to review all key aspects of the Draft Plan in a coordinated fashion. This will avoid highly repetitive comments, and consequently facilitate the Council's review. Hopefully, this will make the comments more useful to the Council, and shorten the Council's response time.

It is not our intention to delay any studies or other activities that are essential to a complete and adequate damage assessment or restoration program. However, it is our understanding that any studies that need to be conducted now are ongoing, and that the requested three-week extension will not affect these or other important planned or ongoing activities.

Given the short time before the current public comment deadline; we ask that you respond to this request as soon as possible, and no later than Friday, September 22, 1989 (which is only one business week before the current deadline). In fact, we would appreciate your response by telephone as soon as it is available (Bob Adler - 202-783-7800; Erik Olson - 202-797-6887; or Sarah Chasis - 212-727-2700), in addition to formal written notice.

Thank you very much for considering this request.

Very truly yours,

Robert W. Adler

Robert W. Adler
Senior Attorney

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List Attachments A & B of Sanders Comments in reference material

COMMENTS

OF

THE NATURAL RESOURCES DEFENSE COUNCIL, INC.

ON THE

STATE/FEDERAL NATURAL RESOURCE DAMAGE ASSESSMENT PLAN

FOR THE EXXON VALDEZ OIL SPILL

(PUBLIC REVIEW DRAFT, AUGUST 1989)

October 27, 1989

Sarah Chasis
Senior Attorney
NRDC Coastal Project

Robert W. Adler
Senior Attorney
NRDC Clean Water Project

Expert Comments By:

Anne McElroy, PhD
Patricia A. Lane, PhD
Howard L. Sanders, PhD
Michael Kavanaugh, PhD
Howard Liljestrand, PhD
D.K. Button, PhD
Steven Wright, PhD
Kim Hayes, PhD
Timothy Vogel, PhD

Legal Intern

John Smeltzer

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Crowell, M.J. and P.A. Lane. The Effects of Crude Oil and the Dispersant COREXIT 9527 on the Vegetation of a Nova Scotia Saltmarsh: Impacts After Two Growing Seasons.

Lane, P.A., 1989. Environmental Effects Monitoring: Pitfalls and Possibilities in Relation to Offshore Oil Development.

Lane, P.A., 1989. Synopsis for Environmental Effects Monitoring: Pitfalls and Possibilities in Relation to Offshore Oil Development.

Lane, P.A., 1988. Reference Guide to Cumulative Effects Assessment in Canada, vol. I.

Lane, P.A., M.J. Crowell, D.G. Patriquin and I. Buist, 1987. Use of chemical dispersants in salt marshes. Environmental Studies Research Funds Report No. 070. Ottawa. 100 p.

Lane, P.A., 1985. Ecological Risk Analysis in Regard to Offshore Oil Development at Hibernia.

INTRODUCTION

The Natural Resources Defense Council, Inc. (NRDC) submits the following comments on the Public Review Draft of the State/Federal Natural Resource Damage Assessment Plan for the Exxon Valdez Oil Spill (August 1989) (hereafter "Draft Plan" or "Draft Assessment"). NRDC has more than 120,000 members and supporters nationwide many of whom use and enjoy areas affected by the Exxon Valdez oil spill.

The overriding concern of NRDC and its members is that the environment of Prince William Sound and other areas of Alaska affected by the spill be restored to the maximum extent possible to the highly pristine, productive state that existed before the accident, and that to the extent this is not possible, replacement habitat be acquired to compensate the American public for these losses. This goal requires an adequate damage assessment plan and restoration plan; yet neither are provided here. By arbitrarily limiting the assessment plan to one year of studies, and by otherwise limiting severely the scope of the assessment plan, the Trustees may seriously underestimate the nature and extent of damage caused by the spill. Moreover, there has been almost no serious planning on ways to restore the long-term productivity of the areas affected by the spill, or to acquire replacement habitats where full restoration is not possible.

Com.	Topic	Issue	Sug.	Sort
1	4	0201		2

NRDC appreciates this opportunity to comment on the draft plan. The opportunity provided, however, is only of extremely limited value. NRDC and other environmental groups have

distributed the plan to a large number of experts around the country qualified to comment on all aspects of the plan. The initial responses of those experts has been virtually unanimous: The Draft Plan is so vague that it is not amenable to serious review by outside experts. The Draft Plan omits important details on all of the proposed studies, making it difficult or impossible to comment intelligently on the merits of the studies.

Com	Topic	Issue	Sug.	Sort
2	3	0102		2

NRDC's comments on the Draft Plan fall into two classes. Our initial comments address broad legal and policy concerns related to the Draft Assessment. In addition, we summarize some of the major points raised by our outside experts. Attached to these comments are specific critiques prepared by nine outside experts on particular aspects of the Draft Plan. Resumes are included for each of these experts. These critiques should not be considered an "appendix", but rather constitute the heart of NRDC's comments on the technical merits of the proposed assessment plan. In order to ensure that the scientists and economists conducting the studies have the benefit of these comments, we ask that all the technical critiques be circulated to each of them.

NRDC's experts focused on broad, ecosystem-wide studies proposed in the Draft Plan, such as the Coastal Resources and Air and Water Pollution Studies. Studies designed to evaluate the effects on individual species are evaluated as they relate to these broad concerns. Where we do not comment specifically on individual assessment proposals, this implies neither agreement

nor disagreement with the proposal. Other environmental groups are working with experts on other specific aspects of the Draft Plan (such as birds, marine mammals and terrestrial mammals).

I. THE ASSESSMENT LACKS ADEQUATE DETAIL TO ENABLE MEANINGFUL TECHNICAL REVIEW

All the technical reviewers that NRDC consulted stated that there was not enough detail provided in the draft plan to permit adequate peer review.[1] Dr. McElroy says that: "The level of detail in the study plan, methods and analyses given and budgets presented would be completely unacceptable in any kind of peer-reviewed grant or contract application." Dr. Lane states: "Although it is clear that many of the main environmental components have been identified for study, it is not so clear that the studies are designed well enough to provide the needed information to quantify damages rigorously. In particular, there is very little information given on sampling design and methods of data analysis and interpretation during the post-collection phase." Dr. Liljestrand noted that the level of detail provided in the Draft Plan would not suffice to pass scrutiny had this plan been submitted by a private party for government agency approval. Dr. Kavanaugh and our other experts reached the same conclusion with respect to other scientific and economic studies.

Com.	Topic	Issue	Sug.	Sort
3	4	0102		2

We appreciate the haste with which the study plan was put together and the tremendous pressures the Trustees and their

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[1] Obviously more detailed information on most of these studies could have been provided since when the Draft Plan was made available most of the studies were already underway.

staffs were under. However, we believe it is in the Trustees' interests, and ultimately in the public's interest, to ensure the most rigorous and effective study regime is adopted, particularly in light of the scrutiny to which the results will be subject in any litigation that will eventually result. Thorough scientific and technical peer review of the study plan in advance is one of the best ways to ensure that the study results are sound and stand up in court.

Ironically, we understand that at the same time that comments on this extremely vague plan are due, far more detailed research proposals are being prepared for circulation to peer review scientists around the country. If true, in essence the public is being excluded from participation in the more important and meaningful opportunities to comment on the assessment.

To this end, we urge the Trustees to provide the opportunity for further peer and public review of the studies proposed to be performed this next spring and thereafter. We formally request that the following steps be taken to ensure proper public input to this process:

1. Copies of these comments, including the specific attached comments of outside experts, should be circulated to all government scientists and economists (including contractors) who are developing and conducting the actual studies;

2. Meetings should be scheduled to allow our outside experts an opportunity to discuss their concerns directly with

the government (or contractor) scientists and economists who are actually developing and conducting those studies;

3. Information on the results of studies to date and detailed proposals for additional research should be circulated to the experts who helped NRDC and other groups review the Draft Plan at the same time they are circulated to other outside experts;[2] and

4. As explained in detail below, the public should be given an opportunity to participate formally in future decisions to continue or discontinue damage assessment studies, and in the development of the restoration plan.

II. THE RESTRICTION OF ASSESSMENT STUDIES TO ONE YEAR IS ARBITRARY AND NOT IN ACCORDANCE WITH LAW.

A. The One-Year Limitation on Assessment Studies Is a Violation of the Trustees' Duty to Recover Restoration Costs

The federal and state trustees for natural resources affected by the Exxon Valdez oil spill are under an obligation to recover costs for the restoration of damaged natural resources in and around Prince William Sound. Section 311(f)(5) of the Clean Water Act provides that designated federal and state officials "shall act on behalf of the public as trustee of the natural resources to recover for the costs of replacing or restoring such resources." 33 U.S.C. §1321(f)(5) (emphasis added). Section 107(f)(1) of CERCLA states that sums recovered be used to

Com.	Topic	Issue	Sug.	Sort
4	4	0201		2

[2] In essence, we ask that our experts be incorporated in the scientific peer review process that the Trustees apparently are conducting anyway.

restore, replace or acquire the equivalent of the damaged resources. 42 U.S.C. §9607(f)(1). To recover such costs and restore the environment, the Trustees first must assess the full extent of injury. An underestimation of injury will lead to an underestimation of restoration or replacement costs, an inadequate recovery from Exxon, and an inadequate restoration of the environment.

The Trustees violate their statutory duties by arbitrarily restricting assessment studies to a period of less than one year. The Executive Summary states: "The damage assessment document is essentially a one-year plan. No further studies will be conducted after February 28, 1990, except those approved by the Trustees upon recommendation of the Trustee Council and scientific and legal review groups as being necessary to promote restoration and to support assessment of legally recoverable natural resource damages." (p. i). However, as the Draft Plan itself states the spill will have long-term effects not discernible within one year. The Draft Plan recognizes that "oil and its complex breakdown products are expected to linger in some areas for many years," (Draft Plan at 1), acknowledges the "possibility of delayed population effects in some species," id. at 15, and states with respect to at least one species that the "full effect of the spill may not become evident this year." Id. at 15.[3] As the comments of Drs. McElroy, Lane, Sanders,

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[3] Elsewhere, the Plan states: "Oil and its complex breakdown products will persist for a long time; the nature and degree of (continued...)

Kavanaugh, Vogel, Wright, Hayes and Button (attached) attest, a responsible damage assessment cannot be done in one year.

Due to the magnitude of the Valdez spill, the unique properties of the affected ecosystem and the virtually certain possibility of long-term and delayed biological injury, a study of at least several years duration is necessary to adequately ascertain the extent of injury and the costs of restoration. The planned termination of data analysis on February 28, 1990, requiring the termination of data gathering in September of this year, bears no rational relationship to the duration of study required to assess damages from the spill and will prevent full recovery of restoration costs.

We understand that all prior drafts of the plan were for 5 years of study and that it was only at the last minute that federal officials in Washington, D.C. ordered that the government commit to only one year of study. That decision is an arbitrary one, driven by political concerns, rather than one justified by science or the public interest.

B. The One-Year Limit On Assessment Studies Is a Violation of the Trustees' Duty to Assess Long-Term Effects

Subordinate to the Trustees' duty to recover restoration costs is an explicit statutory duty to assess natural resource damages. Section 107(f)(2)(A) of the Comprehensive Environmental Response and Liability Act (CERCLA), states that natural resource

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[3](...continued)
toxicity of that oil will vary over time, and will require considerable study to determine its ultimate fate and effects." Id. at 237.

trustees "shall assess damages for injury to, destruction of, or loss of natural resources" for purposes of recovering restoration costs. 42 U.S.C. §9607(f)(2)(A). This provision is made expressly applicable to the oil spill liability section of the Clean Water Act. Id. The duty to assess natural resource damages is violated by the Trustees when they restrict studies in a manner that will result in a failure to ascertain long-term injury.

CERCLA specifically provides that long-term injuries are to be studied. In a section requiring the Department of Interior to draft regulations governing natural resource damage assessment, CERCLA mandates that such regulations include provisions designed to "determine the type and extent of short- and long-term injury." 42 U.S.C. §9651(c)(2). The legislative history of CERCLA demonstrates that Congress was aware of the problem of long-term injury and intended such injury to be addressed. A report by the Senate Committee on Environment and Public Works indicates that the committee received testimony that injuries of long duration do result from spills of oil and other hazardous materials. See S. Rep. No. 848, 96th Cong., 2d Sess. at 84 (1980), and acknowledges that damage assessment includes "evaluation of long-term or delayed impacts on biological systems." Id. at 87. Moreover, in addressing assessment regulations, the report reiterates that provisions governing large or "unusually damaging" spills are to contain "protocols

for field assessment of the type and extent of short- and long-term damage." Id. at 86 (emphasis added).

The regulations ultimately promulgated by the Department of Interior for natural resource damage assessment reflect the statute's focus on the long-term. First, the regulations direct trustees to consider, inter alia, the "duration, frequency, season and time of the discharge or release." Natural Resource Damage Assessments, 43 C.F.R. §11.64(a)(4)(ii) (emphasis added). Second, "injury" is defined as a "measurable adverse change, either long-term or short-term, in the chemical or physical quality" of a natural resource resulting "directly or indirectly" from exposure to oil or hazardous materials. 43 C.F.R. §11.14(v). Finally, the regulations specify various methods for determining injury to biological resources that cannot be performed effectively in a data-gathering period of less than one year. The regulations recognize inter alia, "cancer," "genetic mutations" and "physiological malfunctions (including malfunctions in reproduction)" as categories of injury, §11.62(f)(1)(i). In order for injuries of this nature to be statistically observed, more than one year of study is necessary. For example, for reproductive malfunctions, a growth period of at least one reproductive cycle is essential.

The February 28 termination date for studies restricts field data gathering to a period of six months, since field studies must end before the onset of the Alaskan winter. In this period of time researchers will be unable to obtain statistical data on

delayed population effects and many types of indirect injury that will occur.

As discussed in the comments of Drs. Lane, McElroy, Sanders, Vogel, Wright, Hayes and Button, there are many significant long-term impacts that will not become evident in the first year. Through processes such as bioaccumulation and biomagnification and through the successional stages in benthic infauna described by Dr. Sanders, population impacts will be felt years after the original contaminant release. Dr. Button describes the potential for long-term changes in water chemistry that will persist for long periods, referring to the decade to century life times of hydrocarbons and their products.[4]

By cutting off studies after the first year, it will also be impossible to analyze two related factors that could not possibly be addressed in the initial year. First, it is not possible to study natural resource damages caused by the various responses to the oil spill, including first year cleanup and assessment activities. Given the massive deployment of resources and the tremendous potential for environmental disruption caused by this presence, these effects may be quite dramatic. Exxon and other PRPs are liable for these impacts as well as those caused by the spill itself. Relatedly, failure to continue studies in subsequent years will render it impossible to determine the actual effectiveness of activities conducted in year one.

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[4] Drs. Vogel, Wright and Hayes agree that one-year studies cannot examine water quality phenomena that have longer time scales.

To ignore such impacts and to have decisions about which studies to continue based solely on whether there have been observed effects in the first year would lead to a serious underestimate of the spill's impacts. To cut off studies prematurely not only will preclude full recovery from Exxon in this case, but will prevent a full scientific understanding of both the short- and long-term effects of a major oil spill, an understanding which has been seriously lacking to date and which would help inform future public policy debates. By failing to provide studies to adequately assess such injuries, the Trustees violate both the statute and regulations governing natural resource damage assessment.

C. The Trustees' Violation of Their Statutory Duty To Adequately Assess Damages Is Not Cured By the Provision in the Assessment Plan Allowing for An Extension of Studies.

The need for assessment studies of longer than one year's duration is evident now. Thus while the Assessment Plan proposed by the Trustees provides for an extension of studies after February 28 if "approved by the Trustees upon recommendation of the Trustee Council and scientific and legal review groups as being necessary to promote restoration and to support assessment of legally recoverable natural resource damages," (Draft Plan at 26), this provision does not satisfy the Trustees' duty to ensure that damages are properly assessed and the full costs of restoration are recovered. This extension provision does not obligate the trustees to formally consider extension in any manner and isolates any such consideration from public notice and

review. It thus gives no guarantee that necessary studies will be performed. The recovery provisions of the Clean Water Act and the assessment provisions of CERCLA mandate that the Trustees adopt a reasonable duration for assessment studies before the assessment plan is approved. Piecemeal decisions to extend a particular study here or there cannot replace the function served by a comprehensive, coordinated long-term assessment plan.

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5	4	0200		2

III. THE TRUSTEES MUST PROVIDE PUBLIC NOTICE AND COMMENT ON ANY DECISION TO TERMINATE OR EXTEND ASSESSMENT STUDIES AFTER FEBRUARY, 1990.

If the Trustees retain the February, 1990 deadline for assessment of natural resource damages resulting from the Exxon Valdez Oil Spill, they must provide an opportunity for public participation at the time this deadline is reviewed. The Draft Plan currently provides that the Trustees may extend studies beyond the deadline after consultation with "legal and scientific review groups" and upon a determination by the Trustees that extensions are "necessary to promote restoration and to support assessment of legally recoverable natural resource damages" (Draft Plan at 26). No opportunity for public participation is included in this review process.

However, public participation in the development and amendment of the Draft Plan is required under both the Administrative Procedure Act (APA) and the Department of Interior

(DOI) regulations governing damage assessment.[5] The APA requires federal agencies to give public notice and solicit public comment in connection with any "rule making." 5 U.S.C. §553. "Rule making" is defined as the process of "formulating, amending, or repealing any rule," 5 U.S.C. §551(4), while "rule" is broadly defined to include any "agency statement of general or particular applicability ... designed to implement, interpret, or prescribe law or policy." 5 U.S.C. §551(5) (emphasis added). The Draft Plan is a "statement of particular applicability designed to implement law" that has substantive impact on the rights and duties of affected parties and thus is subject to the APA notice and comment procedures.

The Draft Plan is subject to regulatory notice and comment procedures under 43 C.F.R. §11.32. This section of the DOI assessment regulations provides that any assessment plan or significant modification of an assessment plan must be made available for public comment for 30 days prior to the plan taking effect. 43 C.F.R. §§11.32(c), 11.32(e)(2).

Any decision to terminate or extend assessment studies beyond February 28, 1990 will constitute an amendment or significant modification of the assessment plan. The duration of studies is a critical element of the plan, directly linked to the type and extent of injury that will be detected and the amount of damages that will be assessed. The final decision with respect to termination or continuation of studies, therefore, will

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[5] Sections 101(e) of the Clean Water Act and 117 of CERCLA also evidence a congressional concern for ensuring public participation in the development of plans of this type.

significantly affect the character of the plan. The public must be involved in such an important decision at the time it is made.

To provide meaningful public review, the Trustees should do three things:

1. Provide the public with information regarding the results of studies performed this past summer since those results bear upon the direction of further studies;

2. Provide greater detail on the studies proposed to be performed for upcoming seasons than does the draft plan (which, as the experts state, provides inadequate information to enable proper scientific review); and

3. Allow early enough opportunity for public input so that the public comments can be useful in the design and conduct of the studies that are performed (again in contrast to the process followed in the draft plan where the field studies were completed before there was any public comment).

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6	4	0200		2

IV. THE ASSESSMENT NEEDS TO HAVE MORE OF AN ECOSYSTEMS FOCUS.

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7	3	0111		2

One of the most serious criticisms noted by the scientists who reviewed the draft plan was the lack of an ecosystems approach to studying the effects of the spill. As Dr. Pat Lane observed in her comments:

> All natural populations exist in ecosystems and although many key populations are of interest because of their direct commercial value, studying them in isolation usually will not produce a true representation of total environmental deterioration. Many populations are predators, competitors, or prey in regard to their interactions with other species in the terrestrial and marine foodwebs that exist in and around Prince William Sound. Indirect changes will come about not only from the sublethal and life history changes in the individual populations that inhabit the ecosystems, but also from the altered ecological interactions and foodwebs. A predator population can

> decline not only from the direct effects of oiled feathers or ingested oil, but also from the lack of a critical prey species that was killed previously by the oil spill. There is no evidence that an ecosystem approach will be taken to examine and quantify foodweb effects related to the oil spill. This is exceedingly unfortunate for two reasons. First, from an ecological point of view in the final analysis it is the long-term persistence of the ecosystems of the planet that are of main concern, not just the few species that are associated with direct monetary benefits today. Secondly, focus on populations gives too narrow a definition of damage and must a priori lead to further underestimates in damage assessment.... Thus, if the guilty party were made to pay only for the number of birds or mammals directly killed by the oil spill, for example based on a carcass count, the amount of true damage could be underestimated by orders of magnitude. (emphasis supplied).

Dr. Lane recommends the use of appropriate models at both the population and ecosystem levels to predict multi-generational effects and cites to work she has done previously (copies attached) of both population and ecosystem level risk analyses.

Dr. McElroy also stated this same concern:

> The plan focuses on assessing damage to each resource as an individual unit with emphasis placed on quantification of exposure to oil components, stock size, and in some cases reproductive fitness. Very little effort has been placed on assessing impact on system wide, or interactive processes. For example, how oiling may effect productivity in a given area which in turn may affect species composition and or food resources. Investigation of each resource species as an individual component is extremely costly and may miss subtle effects caused by interactions between species. If species A is severely affected, its former prey may become more abundant which may deplete food resources of species B. In this case the two species don't interact directly, but effects on one can lead to significant effects on the other. In order to get a complete picture of damage to the ecosystem, a comprehensive damage assessment plan should focus on individual species as well as their interactions and functioning of the ecosystem as a whole.

Com.	Topic	Issue	Sug.	Sort
8	3	0100		2

The persistence of hydrocarbons in the sediments and the resulting alterations in benthic communities also are crucial

areas of study. Dr. Howard Sanders, who did pathbreaking work on this issue in connection with the Florida barge spill off West Falmouth, comments on the importance of studying these effects and understanding the threats to fish and shellfish populations dependent on these communities. He recommends methods of study that will allow proper understanding of these effects.

Drs. Liljestrand and Button raise similar concerns regarding the effects of hydrocarbons in the air and water. For example, Dr. Liljestrand comments that the effects of air contaminants must include the dry flux of organic air pollutants onto vegetation (which may affect the plants and result in subsequent intake by plant foragers). Dr. Button notes that the studies seem to ignore long-term chemical changes induced by the hydrocarbons introduced by the spill, and their effect on global as well as regional water chemistry.

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9	3	2040		2

All these comments point to the need for an expanded ecosystems scope which will provide a fuller and more complete assessment of injury than the draft plan proposes.

V. EXXON SHOULD NOT PLAY A MAJOR ROLE IN THE DAMAGE ASSESSMENT AND RESTORATION PLAN DEVELOPMENT OR IMPLEMENTATION.

The Draft Assessment leaves open the question of the role of Exxon and other potentially responsible parties (PRPs) in conducting the damage assessment, and in developing and implementing the restoration plan. In particular, the Trustees "have not decided whether, or to what extent, potentially responsible parties should participate in the damage assessment." Draft Assessment at iii. We object strongly to the possibility

Com.	Topic	Issue	Sug.	Sort
10	3	0207		2

that Exxon and other PRPs will be given a significant role in these tasks.

We do not, of course, object to any requirement that Exxon fund damage assessment and restoration efforts by the Trustees or their agents, as we believe is required by CERCLA and the Clean Water Act, so long as Exxon has no control (outside of the normal public process) over how the funds are spent and how the studies and restoration are conducted. In fact, because it is apparent that many of the problems identified in these comments relate directly to inadequate Trustee resources to conduct the assessment,[6] the Trustees should strongly consider filing a cost recovery action immediately against Exxon and the other PRPs as a means of financing immediate, ongoing damage assessment costs.

However, as explained below, we object on both policy and legal grounds to further involvement by Exxon in the damage assessment and restoration processes.

A. It is Bad Policy to Allow Exxon to Participate in the Damage Assessment and Restoration

Given the potential liability and other consequences faced by Exxon and other PRPs (and the oil industry as a whole) as a result of this oil spill, it is completely unrealistic to expect

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[6] For example, we hear disturbing reports that numbers of samples may be cut back drastically due to financial constraints. This could severely undercut the validity of data and conclusions drawn from those data. Similarly, due to the high cost of fractionizing water samples, only a very small percentage of the samples is being taken for specific fractions; the rest are analyzed for total hydrocarbons. This limits severely the Trustees' ability to determine concentrations of individual hydrocarbon fractions, such as benzene, ethylbenzene, toluene, xylene and other constituents.

that these parties can participate in the assessment and restoration from an objective perspective.

Allowing PRPs to participate in the assessment process is akin to asking the fox how many chickens it ate. Because Exxon is financially liable for any natural resources destroyed or damaged due to the spill or the spill cleanup, it clearly has little incentive to document the full magnitude and severity of those damages. In fact, Exxon has a direct pecuniary incentive to minimize any proof of the damages caused by the spill.[7]

This conflict of interest is far from purely theoretical. Exxon now has been sued by a large number of parties, including NRDC and other environmental groups, commercial interests, and by at least one of the Trustees.[8] Thus, a direct adversarial interest already exists related to the specific issues that will be addressed by the damage assessment and restoration plan.[9] It is completely untenable to give Exxon direct control over matters that are likely to be contested in court between Exxon and the Trustees.

Com.	Topic	Issue	Sug.	Sort
11	3	0201		2

[7] Information collected by NRDC and other groups demonstrates that where PRPs participated in Superfund remedial investigations, treatment options (as opposed to containment or other less permanent remedies) were chosen only 38% of the time, compared to 61% where EPA or states took the lead in remedy selection. This demonstrates the high potential for PRP bias in this type of activity.

[8] We fully expect that suits will be filed by the federal Trustees as well, if the Trustees are to fulfill their public trust responsibilities under CERCLA and the Clean Water Act.

[9] This adversarial relationship was exacerbated by Exxon's recent lawsuit against the State of Alaska. Conceivably, Exxon could use information collected during the damage assessment in its case <u>against</u> one of the Trustees.

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12	3	0207		2

Even aside from the formal conflict of interest related to Exxon's potential financial liability, Exxon clearly has an interest in minimizing the public's awareness of the actual extent of the damages caused by the spill. From the outset, Exxon seems to have been concerned first and foremost about the public relations implications of the spill. We expect that this will continue to guide Exxon's activities. These concerns could jeopardize the objectivity and adequacy of the assessment and restoration. One major factor driving Exxon's behavior, we suspect, is the desire of the oil industry to drill in the Arctic National Wildlife Refuge and other frontier areas of Alaska and the Outer Continental Shelf. It is in the long-term interests of the industry as a whole to attempt to minimize the public's view of the damage caused by this highly visible event.

One might argue that while the concerns discussed above apply to the damage assessment process, they should have little bearing on Exxon's ability to develop and to conduct the restoration plan. Here too, however, Exxon has a direct conflict of interest that may jeopardize the conduct of an adequate restoration effort. Exxon has an interest in deciding whether or how to conduct any given portion of the restoration based purely on whether it will reduce their ultimate liability by a sufficient amount.[10] Indeed, since as confirmed by the State of Ohio decision restoration cost is one measure of Exxon's

[10] Exxon's possible attitude in this regard may be anticipated based on the company's callous refusal to commit to return next summer to continue the cleanup effort.

liability, Exxon has a direct incentive to minimize restoration costs.

While this type of cost balancing may be appropriate for a private corporation, it is completely inappropriate for purposes of the public decision on the appropriate restoration of Prince WIlliam Sound. This critical public decision should be based entirely on biological factors. All feasible efforts should be made to restore the environment of the Sound to as close an approximation of pre-spill conditions as possible.[11]

Allowing the responsible parties to participate in the damage assessment and restoration would be particularly ironic and inappropriate in this case, where the malfeasance or nonfeasance of Exxon, Alyeska and other responsible parties was so directly responsible for the accident, the almost complete failure to contain the accident, and the extremely ineffective cleanup to date. Exxon's poor response to date, which has focused on public relations to the detriment of sound environmental response, renders them completely inappropriate for a significant role in the damage assessment and restoration.

Com.	Topic	Issue	Sug.	Sort
13	3	0207		2

Finally, it may be true that Exxon (and its consultants) have more personnel than the Trustees to devote to the damage assessment and restoration. This does not mean, however, that Exxon should participate directly in these efforts. As explained above, Exxon can and should be required to pay the Trustees, in

[11] As discussed elsewhere in these comments, the Clean Water Act establishes a preferred hierarchy of restoration, rehabilitation and acquisition of replacement resources. While Exxon might decide that acquisition of replacement resources is cheaper than restoration, the Trustees are not free to make this choice. If restoration is feasible, it must be the preferred approach.

advance where necessary, to retain the necessary consultants and other personnel to conduct a completely independent assessment and restoration.

B. It Would Be Illegal to Allow Exxon to Participate Extensively in the Assessment Plan and Restoration

These policy arguments clearly suggest that Exxon should be given no major substantive role in the assessment and restoration. We also believe, however, that even after State of Ohio, assigning Exxon this role under these circumstances would be illegal.

The Clean Water Act imposes a specific trust duty on the Trustees to conduct the damage assessment and restoration. CWA section 311(f)(5) provides:

> The President, or the authorized representative of any State, shall act on behalf of the public as trustee of the natural resources to recover for the costs of replacing or restoring such resources. Sums recovered shall be used to restore, rehabilitate, or acquire the equivalent of such natural resources by the appropriate agencies of the Federal Government, or the State Government.

(emphasis added). This language indicates that the Trustees have the responsibility to conduct the damage assessment and restoration effort, and prohibits the delegation of this trust duty to an outside party,[12] particularly outside parties with a direct adverse interest.[13]

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[12] We do not suggest that specific portions of the assessment or restoration cannot be performed by independent outside contractors, who have no interest in the outcome, and who are under the direct supervision of the Trustees.

[13] With respect to restoration, the Conference Report on the 1977 Clean Water Act Amendments, which added sections 311(f)(4) and (5), confirms that the "measure of liability is the reasonable costs actually incurred by Federal or State authorities in replacing the resources or otherwise mitigating the damages." H. (continued...)

Similarly, section 107(f)(1) of CERCLA provides:

> The President, or the authorized representative of any State, shall act on behalf of the public as trustee of such natural resources to recover for such damages. Sums recovered by the United States Government shall be retained by the trustee ... for use only to restore, replace, or acquire the equivalent of such natural resources. Sums recovered by a State as trustee under this subsection shall be available for use only to restore, replace, or acquire the equivalent of such natural resources by the State.

(emphasis added). CERCLA section 107(f)(2)(A) and (B) proceed to elaborate that the assessment of natural resource damages must be performed by federal and state officials, respectively, designated by the President and the Governor of the affected state.

Section 104 of CERCLA does authorize the President to allow a PRP to conduct removal or remedial action, when the President determines that such action will be done properly and promptly. The definitions of "'remove' or 'removal'" and "'remedy' or 'remedial action'" (CERCLA sections 101(23) and (24)) describe cleanup tasks, as distinct from natural resource damage assessment or restoration activities. By contrast, the natural resource damage assessment and restoration provision (section 107(f), uses the terms "restore, replace, or acquire the equivalent of such natural resources." Thus, even if Congress intended to allow the PRP to conduct a cleanup, it did not intend to allow PRPs to conduct the damage assessment or restoration.

This distinction makes perfect sense. The PRP may have a direct interest in conducting a prompt and adequate cleanup, so

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[13](...continued)
Conf. Rep. 830, 95th Cong. 1st Sess. 92 (December 6, 1977) (emphasis added).

as to minimize potential liability for natural resource and other damages. But as explained above, the PRP has a direct conflict of interest with respect to the natural resource damage assessment and restoration.

Despite this statutory distinction, the State of Ohio decision (we believe incorrectly) allows the Trustees flexibility to delegate purely ministerial duties related to the damage assessment to PRPs. The Court made it clear, however, that such duties must be supervised closely by the Trustees, and only consistent with a lawfully-developed assessment plan. For the policy reasons discussed above, we do not believe that the Trustees should exercise this flexibility in this case.[14] Exxon has not proven itself sufficiently reliable and objective to serve the public interest in these tasks.

Equally important, because of the extremely vague nature of the assessment plan, implementation of all or any part of the plan by Exxon would be more than purely ministerial. The plan gives little or no guidance on such critical issues as location of sampling, size and numbers of samples, analytical techniques, data preservation methods, quality control procedures, and other issues which severely affect the results of the studies. To delegate such decisions to Exxon would seriously compromise the study effort and give them major rather than ministerial responsibilities in conducting the assessment. Given the magnitude and complexity of this damage assessment, we doubt

Com.	Topic	Issue	Sug.	Sort
14	2	0100		2

[14] The Trustees note repeatedly that no decisions have been made on whether to follow the Interior Department assessment rules, in whole or in part.

whether sufficient guidance can be provided to render Exxon's role purely ministerial.

Also because of the extremely vague nature of this assessment plan, allowing Exxon or other PRPs to participate directly in the damage assessment and restoration would violate the due process and public participation rights of NRDC and other parties who have a strong interest in the adequacy of these processes. The Trustees' decisions on appropriate remedial action, the monetary value of the resources lost or damaged due to the accident, and on the appropriate restoration, replacement or acquisition actions, are formal administrative decisions subject to the Administrative Procedure Act, section 101(e) of the Clean Water Act, section 117 of CERCLA, and relevant provisions of state law. Particularly if the plan remains as vague as it is now, the parties who actually conduct the assessment and restoration will end up making important decisions, <u>without public input</u>, on how the assessment and restoration will be conducted. Allowing Exxon or other PRPs such a direct role in decisions related to the conduct of the damage assessment and restoration gives one set of interested parties a clear preference and advantage in this public process. This would violate fundamental tenets of due process and public participation in agency decisions.

Com.	Topic	Issue	Sug.	Sort
15	2	0207		2

VI. THE TRUSTEES SHOULD PROCEED QUICKLY WITH THE DEVELOPMENT OF A COMPLETE RESTORATION PLAN.

Com.	Topic	Issue	Sug.	Sort
16	3	2110		2

Although the cover letter to the draft plan indicates that the document includes both a draft natural resource damage

assessment plan and a draft restoration strategy, no actual proposed restoration strategy is included in the document.[15] Instead, the document includes only an extremely brief discussion of how the proposed restoration plan will be developed in the future. This brief discussion provides no information on the direction the Trustee Council is considering for a restoration plan, or even possible options. Nor does the discussion even include a precise schedule for the development of such a plan.

The draft plan should have included a far more detailed discussion of this issue. In particular, as required by the State of Ohio decision, the total damages assessed against Exxon must include the cost of restoration or replacement, to the extent possible, and to the extent restoration or replacement is not possible, the cost of acquiring replacement resources or habitat. Thus, the restoration plan has a direct relationship to, and therefore should be prepared as a part of, the natural resource damage assessment plan.

But given that the plan announces an intent to seek substantial additional public comment as it proceeds with the development of a restoration plan (we agree this additional opportunity for comment is legally necessary), we urge the Trustees to proceed with the development of the restoration plan as quickly as possible. While we recognize that some elements of the restoration plan require a more detailed assessment of what resources were lost or damaged due to the spill, development of

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[15] We use the term "restoration" to include restoration, replacement, and acquisition of replacement resources and habitat. As discussed extensively below, the Trustees should ensure similar inclusive terminology.

the restoration plan does not have to be put completely on hold while this information is collected. With respect to some types of resources, sufficient information is available now to prepare at least an initial draft of a restoration plan. This plan can be revised as more complete information becomes available.[16]

Moreover, given that an entire year of data collection has already occurred for most of the studies included in the draft restoration plan, it is unclear why certain aspects of the restoration cannot begin next summer. We recognize that the Trustees must balance the goals of conducting a detailed damage assessment and conducting restoration activities that may obscure the damage assessment process. We also understand that, in some cases, initiation of restoration work may have to await additional information on the nature and extent of damage.

The overriding objective, however, must be to restore the affected environment as quickly and completely as possible. Therefore, well-considered restoration work should begin next year wherever possible, particularly where success will be improved if restoration begins more quickly.[17] As a corollary, since the public must have a fair opportunity to comment on proposed restoration activities, a proposed restoration plan must

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[16] With respect to resources for which even less information is available, the Trustees could at least scope out the components of the restoration plan that need to be developed.

[17] This is not to say that the Trustees should rush to implement restoration procedures that may be ineffective or counterproductive. See comment 4 below.

be prepared this winter, at least with respect to those activities that may begin next year.[18]

When the restoration plan is developed, it should incorporate the following concepts, at a minimum:

1. The restoration plan must include full consideration of restoration, replacement, and acquisition of replacement resources and habitat. Currently, for example, the draft plan includes no reference to acquisition of replacement resources or habitat. See Draft Plan at 27-28.[19]

Proper consideration of all of these strategies is essential for a number of reasons. First, as noted by many of the experts who commented on the draft plan, complete restoration of the environment of Southcentral Alaska is not possible. Therefore, replacement or acquisition will be necessary to compensate the American public and the environment fully for the damage caused by the spill.

Second, currently the studies identified in the damage assessment plan do not focus on the full range of restoration, replacement or acquisition strategies. For example, no study specifically aims to identify the types of habitat that may be priorities for additional acquisition, and to identify potential

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[18] Our concern that an opportunity to comment might postdate the actual work is well-founded, since this is precisely what occurred with respect to the first year of field data collection on the damage assessment studies.

[19] As discussed above, cleanup, which involves removal of oil and other contaminants, should not be confused with restoration, which focuses on the biological functioning of the affected environment. Thus, "bioremediation" techniques, while potentially desirable cleanup methods, do not constitute restoration.

target acquisition areas not currently under public ownership, or that are not currently protected. Similarly, no studies address specifically such issues as the feasibility of restocking populations, or the feasibility of restoring polluted benthic habitat. The draft restoration plan must address these issues.

Third, the restoration plan should identify replacement and, in particular, acquisition opportunities that might be time-limited. For example, the Trustees may elect to protect additional habitat in Prince William Sound by repurchasing timber leases or by cancelling pending timber sales in the Chugach National Forest, and by recommending more areas of the forest with important fish and wildlife habitat for wilderness designation.[20]

Similarly, should the Trustees decide that additional marine habitat should be protected to compensate for habitat lost due to the spill, opportunities for acquisition must be identified quickly. Viable opportunities include repurchasing existing oil and gas leases in Bristol Bay or other areas of Alaska, which would protect critical habitat for many of the species affected by the spill, or the creation of a Prince William Sound Memorial Marine Sanctuary in areas that are currently subject to logging, oil and gas or other development pressures.

2. The restoration plan must consider all aspects of the environment of the affected area, and not just commercially important or other commonly-recognized species. Instead, the

[20] Decisions on some pending timber sales have been postponed due to the spill. Obviously, these sales must be reconsidered in any event to account for the major new biological stresses caused by the spill.

restoration plan must be designed to restore, replace, or acquire replacement habitat for all affected species, and all affected environmental qualities. In short, the goal is restoration or replacement of the total environment, and the environmental productivity and diversity that existed before the spill.

3. The restoration plan should focus on qualitative as well as quantitative environmental measures. For example, a restoration plan that focuses only on numbers of species and numbers of organisms might supplant the affected environment with a somewhat modified ecosystem, in lieu of true restoration. Thus, the plan should consider not only numbers of species, but the specific types and distributions of species in the region before the spill. Similarly, the plan should focus not only on population size, but also on the relative size of various populations that interact in the environment. This will ensure that the affected environment is returned to as close a condition as possible as existed before the spill.

In addition, the restoration must focus on wilderness and other aesthetic values, in addition to purely biological factors. Prince William Sound, Kenai Fiords National Park, Katmai National Park and Preserve, Kodiak National Wildlife Refuge and other affected areas are recreational resources for thousands of people, and were intended to be preserved in their pristine, natural state for future generations. National parks and other conservation system units in particular were created by law

specifically for wilderness and other recreational purposes.[21] These purposes, as set forth in relevant organic legislation, land use and conservation plans, and other documents should be reviewed as part of the restoration planning process. For example, to the extent that the full wilderness values of an affected national park cannot be "restored", these values should be replaced through acquisition of other areas.[22]

4. Extreme care should be taken with artificial "restoration" and "rehabilitation" techniques.[23] While we encourage the Trustees to consider the full range of restoration and replacement options, and to employ options that are promising, some "restoration" techniques may do more harm than good, depending on the circumstances, location, and intensity of use. For example, salmon hatcheries may increase the local salmon population and harvest, at the expense of the integrity of wild salmon stock. Other efforts, such as restocking of wild populations, may require considerable time and resources, with limited success. The same resources may be spent more effectively by acquiring replacement habitat to support remaining local populations while the affected regions recover naturally. While we do not intend to choose particular options at this time,

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[21] For example, the entire coast of Katmai National Park, much of which was affected by the spill, is designated wilderness.

[22] Obviously, this determination is relevant to the final damage assessment to the extent that funds are needed to acquire additional land resources.

[23] We do not consider techniques such as "bioremediation", which uses nutrients to encourage bacteria growth as a means of removing oil, to constitute "restoration". These techniques are properly considered cleanup activities.

we urge the Trustees to consider the full costs and effects of all possible restoration strategies before particular strategies are selected.

5. As with the damage assessment, the restoration plan must provide, to the maximum extent possible, for the renewal of the long-term productivity and diversity of the affected environment, and not just for the elimination of short-term, chronic effects. For example, it is not sufficient simply to eliminate acute toxicity in the environment and to replace the most obvious species to their original numbers. Efforts must be made to ensure that the structure, function and productivity of the food chain and other aspects of ecosystem function are restored to the greatest extent possible. Similarly, attention must be given to sublethal effects, such as the reproductive success, growth potential, and overall health of individuals, as well as direct mortality.

6. The restoration plan must address damages caused by the cleanup and other response activities conducted this summer, as well as damage caused by the spill itself.

VII. THE TRUSTEES MUST DECIDE WHAT ASSESSMENT STANDARDS AND PROCEDURES WILL BE USED IN THE ASSESSMENT, AND ALLOW PUBLIC INPUT INTO THOSE DECISIONS.

The Draft Assessment repeatedly notes that no decisions have been made on such critical decisions as whether the Interior Department damage assessment rules will be used, in whole or in part, and what measures of damage will be used in the process.

Com.	Topic	Issue	Sug.	Sort
17	3	2209		2

These statements ignore two critical factors. First, the State of Ohio decision set forth critical guidance on what

aspects of the rules may or may not be used, and on what basic economic valuation principles must be used in the assessment process.[24] For example, the decision makes clear that the Trustees may not employ the "lesser of" concept in Interior's rules, or any variant on that principle. Rather, restoration cost must be considered the preferred approach unless restoration is technically impossible or grossly disproportionate to the value of the resources. Conversely, the decision makes clear that the measure of damages must exceed restoration costs; the lost use and nonuse values also must be assessed in order to make the public and the environment whole. In such cases, the Court explained that additional damages should be used to acquire replacement resources or habitat. Finally, the Court noted that lost use values should not be based exclusively on "market factors." All reliable means of calculating the value of the resource must be employed.[25]

The draft assessment must be revised in light of the decision in State of Ohio to expand the economic studies to evaluate the costs of restoring, replacing or, where neither is possible, acquiring equivalent resources elsewhere. The economic studies described in the draft plan, however, emphasize lost use values to the exclusion of restoration. The comments of economist Mike Kavanaugh (attached) make clear the need to expand

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[24] Economic issues are addressed in greater detail in the attached comments of Michael Kavanaugh.

[25] The Draft Assessment continues to obfuscate this issue by indicating that lost use values will be considered in the assessment, without defining the types of uses that will be considered and the methods of valuing those uses.

the scope of analysis; in addition, he suggests ways to improve the proposed studies assessing lost use values.

Second, the standards and procedures that will be used in the damage assessment will have a critical effect on the results of the analysis. As such, the public has an absolute right to comment on these decisions. Moreover, since the procedures and economic methods that will be used to value the resources lost or damaged due to the spill may affect the types of scientific studies that are conducted, or vice versa, it is not sufficient to allow public participation on this issue after all of the scientific studies are completed. Public input into these decisions should be allowed, therefore, as soon as possible.

VIII. THE TRUSTEES SHOULD INCORPORATE THE VIEWS OF A BROADER SCOPE OF EXPERTS AND RESEARCHERS.

As noted above, we request that NRDC's experts play a role in the formal peer review process being used by the Trustees. We also believe, however, that other legitimate views may be excluded from the ongoing damage assessment process.

Com.	Topic	Issue	Sug.	Sort
18	3	0200		2

For example, the role of the National Park Service is not spelled out in the Draft Plan, leaving it unclear whether their views are properly being considered. Extremely important national park lands were affected by the spill, yet only the U.S. Fish and Wildlife Service (FWS) is listed as the Interior Department's Trustee representative. This role should be shared between FWS and NPS, to ensure that the interests of valuable park lands are protected, and to take full advantage of the data collected by NPS during and after the accident.

Similarly, the Draft Plan appears to ignore entirely the fact that much independent research and information collection is being conducted in the areas affected by the spill. This ranges from formal scientific research by independent scientists, to coordinated or anecdotal efforts by citizens to identify carcasses, oiled beaches and other readily-identified effects of the spill. The assessment plan should discuss a formal effort to collect and use, as appropriate, this information collected by outside sources.

CONCLUSION

The Draft Assessment Plan fails to provide sufficient detail to allow serious public comment on the conduct of the Exxon Valdez damage assessment and restoration planning processes.

Nevertheless, it is apparent from the information provided that the plan contains serious flaws that may jeopardize both the damage assessment and the restoration plan. Most notably, the general proposal to limit the plan to one year of studies will seriously underestimate the natural resource damages caused by the spill. Moreover, the Trustees' failure to initiate serious restoration planning calls into question their commitment to a comprehensive, long-term restoration of the affected environment, or to purchase replacement resources and habitat where full restoration is not possible.

We urge the Trustees to correct the violation of our public comment rights by allowing additional opportunities to comment on all future key decisions related to the damage assessment and restoration. More important, the Trustees should broaden the scope and duration of the damage assessment plan, and initiate

careful restoration planning immediately, consistent with these comments and the attached comments of our experts.

ATTACHMENTS - COMMENTS OF EXPERT REVIEWERS

Comments of Dr. Anne McElroy

Comments of Dr. Patricia A. Lane

Comments of Dr. Howard L. Sanders

Comments of Dr. Michael Kavanaugh

Comments of Dr. Howard Liljestrand

Comments of Dr. D.K. Button

Comments of Drs. Steven Wright, Kim Hayes and Timothy Vogel

APPENDIX (Studies referred to in the comments of Dr. Patricia A. Lane)

Crowell, M.J. and P.A. Lane. The Effects of Crude Oil and the Dispersant COREXIT 9527 on the Vegetation of a Nova Scotia Saltmarsh: Impacts After Two Growing Seasons.

Lane, P.A., 1989. Environmental Effects Monitoring: Pitfalls and Possibilities in Relation to Offshore Oil Development.

Lane, P.A., 1989. Synopsis for Environmental Effects Monitoring: Pitfalls and Possibilities in Relation to Offshore Oil Development.

Lane, P.A., 1988. Reference Guide to Cumulative Effects Assessment in Canada, vol. I.

Lane, P.A., M.J. Crowell, D.G. Patriquin and I. Buist, 1987. Use of chemical dispersants in salt marshes. Environmental Studies Research Funds Report No. 070. Ottawa. 100 p.

Lane, P.A., 1985. Ecological Risk Analysis in Regard to Offshore Oil Development at Hibernia.

COMMENTS AND RESUME

OF

ANNE McELROY, PhD

COMMENTS ON THE DRAFT STATE/FEDERAL NATURAL RESOURCE DAMAGE ASSESSMENT PLAN FOR THE EXXON VALDEZ OIL SPILL RELEASED IN AUGUST 1989, PREPARED SEPTEMBER, 1989

Anne McElroy
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Environmental Sciences Program
University of Massachusetts-Boston

Scope of Review:

As stated in the Federal Register, public comments are being requested to ensure that:

1) important resource concerns are not omitted,
2) the methodologies receive independent review,
3) that appropriate methodologies are chosen for assessment, and
4) that the costs of the assessment are reasonable.

The Register notice also states that additional work will only be done if such study is required to support legal recovery of damages for harm to natural resources if such studies are justified scientifically and are consistent with the objective of restoration of the ecology of the effected area.

As noted in the Register, to expedite damage assessment, all studies were begun prior to publication of the Assessment Plan. Indeed, according to the plan all data collection should be finished by mid September 1989, prior to the receipt date for comments. Data analysis will continue until February 28, 1989. Comments at this point can only serve to criticize the Draft Plan and make suggestions for additional work in the future. Without any preliminary data, suggestions will be speculative. Considering the huge expenditure of funds (35 million) committed to this plan, independent review prior to commencement of study should have been obtained.

Com.	Topic	Issue	Sug.	Sort
19	3	6300		2

To purpose of the plan is to determine the extent and magnitude of injury to natural resources of Prince William Sound and the adjacent Gulf of Alaska in support of the development of a restoration plan to promote the long-term recovery of natural resources and to support damages to be claimed for the loss of services.

The plan focusses on assessing damage to each resource as an individual unit with emphasis placed on quantification of exposure to oil components, stock size, and in some cases reproductive fitness. Very little effort has been placed on assessing impact on system wide, or interactive processes. For example, how oiling may effect productivity in a given area which in tern may affect species composition and or food resources. Investigation of each resource species as an individual component is extremely costly and may miss subtle effects caused by interactions between species. If species A is severely affected, its former prey may become more abundant which may deplete the food resources of species B. In this case the two species don't interact directly, but effects on one can lead to significant affects on the other. In order to get a complete picture of damage to the ecosystem, a comprehensive damage assessment plan should focus on individual species as well as their interactions and functioning of the ecosystem as a whole.

The goals of the major sections of the plan are summarized below:

Part I: Injury Determination/Quantification:

Coastal Habitat: to measure spill-related changes in supra-, inter- and subtidal zones.

Air/Water: to determine the distribution and composition of petroleum hydrocarbons in water, sediments, and living resources (ie. determine the dose).

Fish/Shellfish: to quantify numbers and effects in major fisheries species.

Marine Mammals: quantify deaths, pathology and toxicology as well as number and distribution.

Terrestrial Mammals: quantify damage to coastal species which would consume contaminated aquatic species and run laboratory experiments to assess effects on mink as a model.

Migratory birds: quantify mortality, population census, reproductive success.

Technical Services: Provide the expertise and coordination to ensure accurate and verifiable measurements of hydrocarbons in all samples, histopathological measurements in tissue samples, and mapping of results obtained.

Part II: Development of the Restoration Plan and Implementation Plan:

Part III; Damage Determination: Economic Value of Resource Use

In the summary statement at the beginning of the plan, the following criteria were given for choice of the studies included into the plan:

1) likely validity of impact hypothesis,
2) soundness of scientific approach,
3) cost-effectiveness, and
4) coordination with related work.

From the information presented in the plan, it is very difficult to assess how well each study met these criteria. Considering the extent of the spill, it is likely that all of the resources under investigation would be affected in some way. Therefore the hypothesis of impact is a moot point. The individual studies only justified the importance of the specific resource under investigation, not the soundness of the scientific approach. In many cases an adequate description of what will actually be measured is absent. Details of sampling and analysis are also sparse, making analysis of the approach and particularly the cost-effectiveness impossible.

I have gone through the details of the Coastal Habitat, Air/Water,

Fish/Shellfish, and Technical Services portions of the proposal, have made specific comments on each, and prepared a brief overall summary statement.

GENERAL COMMENTS ON THE PORTIONS OF THE PLAN REVIEWED

In all cases it is impossible to tell if the budgets are appropriate because no details are given on sample size, number of man-hours needed, specific equipment, or anything else. The level of detail in the study plan, methods and analyses given and budgets presented would be completely unacceptable in any kind of peer-reviewed grant or contract application.

Com.	Topic	Issue	Sug.	Sort
140	5	0102		2

In most of these studies, it is also impossible to tell if the methods to be used are appropriate, again due to lack of information presented. The QA/QC plans given in Appendix A and B for chemical analysis and histopathology analysis indicate field sample collectors and analysts will all be properly trained and that appropriate blanks and standards will be run, and that periodic inspection and intercalibrations will be conducted. No similar description of QA/QC is given for the other measurements described in the plan. A large concern is the speed at which this study was undertaken, and the early date at which it is to be completed (2/28/90). Judging by the dates attached to the signatures on the QA/AC plans, much of this work was already in progress before this document, or standard analytical procedures were agreed upon.

Considering the magnitude of the task, it is impossible to believe that these analyses will be completed by March, 1990. If not, when will the information be available. No time-lines for interim reports or data coordination are given. This will be essential to damage assessment and making informed decision on what portions of this study, or addition work may need to be done in subsequent years. Almost no information is given about coordination, specifically when each of these studies will be done, if different portions will be coordinated temporally, who will be responsible for coordinating sampling, analysis, and data transfer. Formation of the Analytical Chemistry Group and the Histology Technical Group to oversee all QA/QC, and I hope coordinate data evaluation, is a step in the right direction. Similar coordination and oversight groups should be developed for the other types of data to be generated.

Com.	Topic	Issue	Sug.	Sort
141	5	0201		2

Com.	Topic	Issue	Sug.	Sort
142	0	0100		2

The studies as presented appear to be mostly descriptive, in some cases grossly over-sampling specific habitats or species. There is a tremendous amount of information available about the effects of oil on organisms (NRC, 1985). Information obtained from other similar spills should also be utilized (e.g. the Amoco Cadiz which grounded near a rocky coast in temperate waters). This work should not be repeated, rather the information from these studies should be utilized. Short-term efforts should be focused on clearly documenting the extent of oiling and effects on key resource species. This is adequately, and in some cases excessively covered in the plan. However, additional study should focus and measuring and predicting the reservoirs, movement and availability of oil which remains in the system, and in quantifying long-term effects on resource populations and community function and structure. Possibly monetary damages could be assessed in two phases, immediate and continuing.

Com.	Topic	Issue	Sug.	Sort
20	3	0108		2

Com.	Topic	Issue	Sug.	Sort
21	4	0100		2

Assessment of short-term effects on these species will generate data needed to calculate immediate monetary damages. In addition, provisions must be made to assess the economic values of long-term, more subtle damages. For example, persistent changes in benthic community structure or productivity might represent a significant enough change in food resources to cease to support a given commercial species in a given area. If the coupling between community productivity and decomposition is significantly disturbed, anoxic conditions could develope which would render the area unsuitable for many species. Determination of the movement, persistance and availability of oil in the benthos is essential to the prediction of long-term effects. Information of this type will be more useful to understand the fates and effects of oil in this system and predict future fates and effects of the oil from the Exxon Valdez as well as other spills which will undoubtedly occur in the area.

Ecosystem function parameters have been largely left out of this study. Community structure will be evaluated in the Coastal Habitat Study, and in some of the fish studies the age/size distribution of individual species will be documented, but little effort has been made to access the functioning of the ecosystem. Particulary in the near-shore estuarine habitats primary and secondary productivity as well as system respiration and organic mater decomposition should be assessed in selected areas. In the Amoco Cadiz petroleum degradation by microbes was significant, and researchers felt that the relative decrease in abundance of hydrocarbon metabolizing bacteria with time was a good indicator of recovery. Investigation of oil degrading microbes is absent from the plan of study. Similarly, structural and functional analysis of micro and macro plant and algal communities appears to be left out of the study plan. Coastal and submerged plants and algae should be included in the study, as these species can be important habitat in themselves and form the basis of the food chain.

Com.	Topic	Issue	Sug.	Sort
22	3	0100		2

Another aspect that could be better addressed concerns the fate of persistent oil components. Analysis of hydrocarbons in the sediment and pore waters should be documented for years. Twenty years after the oil spill near West Falmouth in Buzzards Bay, MA, oil was found in marsh sediments (John Farrington, pers. comm.). In the Amoco Cadiz spill oil migrated down through beach sands and cobble to the beach/water table interface. Movement through subsurface waters has not been addressed here. Oil buried in beach sediments may be quite persistent and would be re-released during winter storm events. The magnitude of this annual re-infusion of relatively unweathered oil should be assessed. As mentioned above, the air-sea interface also seems to have been neglected.

Com.	Topic	Issue	Sug.	Sort
23	3	2010		2

Study of the Amoco Cadiz oil spill for 20 months demonstrated the persistance of oil in nearshore sediments, and the persistance of alterations in benthic community and coastal marsh habitats. Indeed these later two parameters should little evidence of recovery during this period. Considering the colder waters of the arctic, recovery may be much slower. Clearly portions of these studies must be continued for at least several years, with some analyses continued even longer. The damage assessment plan presented, if conducted properly, should be able to support calculation of the immediate monetary damages associated with the Exxon Valdez spill, but some provisions must be made for careful study to assess long-term damages.

COASTAL HABITAT INJURY ASSESSMENT

Overall goals are to determine:

1) abundance of intertidal and subtidal organisms used as food by resource species,
2) contamination of these food resources by oil,
3) quantification of injury over the entire 600 mile affected area, and
4) recovery of various habitat types after clean-up treatments.

Although not specifically stated in goals, attempts will also be made to assess potential impacts of clean-up efforts on the above. This portion is mostly aimed at looking at food chain effects, both for lack to food items and food chain transfer of oil.

Study 1: Comprehensive Assessment of Injury to Coastal Habitats

Description:

Phase 1: categorize coastline into 5 representative coastal habitat types, with representatives of each with low, med, and high oiling. Selection of sites will be "statistically valid" and ground-truthed through a reconnaissance survey. Study design will allow extrapolation to entire 600 mile affected area. Initial selection will be based on exiting coastal morphology scheme and shoreline impact survey maps prepared by Technical Services Study 3#. Ground-truthing will establish approx. 150 study sites.

Phase 2: assess changes in critical trophic levels and interactions, and assess changes in terms of quantity (biomass, productivity) and quality (vigor and utility to other trophic levels) and composition (community composition, diversity and standing crop of key species).

These data will be used to:

1) assess injury to beach sediment and soils,
2) establish response of these parameters to oiling and clean-up,
3) estimate rate of recovery and potential for restoration, and
4) provide linkages to other studies.

Methods:

Phase 1: using GIS pick 3 rep. sites, for each of 45 categories (3 regions x 5 habitat types x 3 degrees of oiling) plus extras = 150. Visit to check and photograph sites, establish boundaries, and describe sites.

Phase 2: study 4 vertical transects through all 3 tidal zones at each site. Chemical analysis of sediment will include hydrocarbon composition as well as determination of volatile organic compounds. The percent of sediment covered with oil, depth of oiled sediment, salinity and soil/sediment texture will also be determined. Biological analyses will include community composition, cover, and standing stock for each trophic level measured. Dominant producing and prey organisms will be designated as key species and estimates of quantity and quality made to assess their contribution to energy flow in the habitat. Amphipod LC50 bioassays will be done to assess sediment toxicity. Samples of

key species will be analyzed for hydrocarbon content. Additional species may be investigated to support other projects. It appears that some of these parameters will be followed over time, as changes over time are mentioned.

Comments:

As described, this study could provide extremely valuable information as to the effect of oil on benthic community structure, the extent of contamination by various oil components in the coastal zone of the entire effected area, and some estimate of how the oiling of benthic communities may affect species feeding on these organisms either due to lack to food (due to death of prey organisms) or food chain transfer of hydrocarbon contaminants (based on the hydrocarbon content in key prey items observed).

Com.	Topic	Issue	Sug.	Sort
24	1	1110		2

It is impossible to tell from the information given how well these objectives will be realized. Measurements will be made along 4 transects at each of 150 sites. No information is given about how many of each type of measurement will be made along these transects, or what methods will be used. No mention of the time scale for sampling is given. Will some of these be visited just post spill, and others only at the end of the summer? The only way to really assess damage to these habitats and predict recovery or plan recovery strategies would be to revisit a representative number of sites on an annual basis for at least several years, with less frequent sampling at multi-year intervals for a least a decade. On the recent 20 year anniversary of the West Falmouth oil spill in MA signs of oil were still present in subsurface sediments.

Com.	Topic	Issue	Sug.	Sort
25	3	1110		2

Although alluded to, no specifics are given on how the success of the beach steam cleaning operations will be assessed. Paired measurements between beaches that were manually cleaned and those which were left alone could determine whether or not these efforts had any long-term effect on the removal of oil and toxicity to organisms. It is quite likely, in my opinion, that steam cleaning may have done more harm than good. This would be a perfect opportunity to assess this before any more "steaming" is done next year.

Com.	Topic	Issue	Sug.	Sort
26	4	2120		2

In principle this study, if adequately carried out and scaled down to a manageable number of sites, would be a good start to assess coastal habitat damage. In addition to the chemical analysis of sediment and biota, species abundance and composition analysis, and sediment toxicity bioassays proposed, plants and algae should be included in the abundance censuses and be analyzed for hydrocarbon content. As the basis of the food web and important habitats in themselves, the effects of oil on these species should definitely be quantified.

Com.	Topic	Issue	Sug.	Sort
27	3	2120		2

It would be helpful to get an estimate of community function in coastal habitats. Primary and secondary productivity should be assessed in the intertidal and nearshore water column and benthos. This will mean analysis of phytoplankton, submerged vegetation and macroalgae as well as determination of organic carbon and hydrocarbon turnover by microbes. Benthic community respiration rates might also yield useful relative information about impacted and control habitat function.

AIR/WATER RESOURCES INJURY ASSESSMENT

WATER RESOURCES

Overall goals are to:

1) map the extent and persistance of floating oil (slick, mouse, tar balls) over the study area, and verify that this material came from the Exxon Valdez,
2) quantify the geographic and temporal distribution of dissolved and particulate oil in the water column, and
3) document levels of petroleum hydrocarbons in subtidal and deep water sediments and biota

Study #1: Geographical Extent and Temporal Persistence of Floating Oil from the Exxon Valdez

Summary: This is primarily a mapping project which will utilize exiting aerial photographs following the progression of the spill, and apply mathematical models to predict coastal impact, and amount of floating oil. Satellite imagery will also be employed. Samples of floating oil will be analyzed for hydrocarbon content and distribution to "fingerprint" the oil in the hope of assigning it to that carried by the Exxon Valdez.

Comments: Use of aerial and satellite images over time should be very useful to map surface oil movement, and document all shore areas impacted. Fingerprinting the oil (particularly before had weathered significantly should help to implicate the Exxon Valdez).

Com.	Topic	Issue	Sug.	Sort
28	1	1210		2

Study #2: Petroleum Hydrocarbon-Induced Injury to Subtidal Marine Sediment Resources

Summary: This study will analyze total petroleum hydrocarbons (TPH) by gas chromatography (GC) and polycyclic aromatic hydrocarbons (PNA) by GC-mass spectrometry with selective ion monitoring (SIM) in subtidal and deep sediments as well as sediment grain size and organic carbon content in offshore areas known or expected to have been oiled and nearshore sites in coordination with the intertidal sampling sites established by the Coastal Habitat study. Site selection will be based on areas likely to have received oil, sensitive areas (hatcheries and estuaries), and areas near to oiled coastal habitats. Sampling will be done in Prince William Sound, Kenai Fiords, the Kodiak Island area and additional locations extending to the Aleutian Chain. In Prince William Sound a manned submersible will be used to visually check areas for the presence of oil. Hydrocarbon analysis will be done on the top 2 cm of the sediment. If preliminary screening indicates the absence of oil, GC-MS will be omitted.

Comments: This study should give an accurate picture of how much and what components of the oil are contaminating surface sediments in deep and nearshore areas. The analytical methods should be appropriate, but again, no indication is given of exactly how many samples will be analyzed. If these data are to support the coastal habitat study, the same sampling and chemical methods must be used. Since hydrocarbon concentrations in the sediments of some of these areas should be high, it would be very useful to also measure

Com.	Topic	Issue	Sug.	Sort
29	3	1220		2

these compounds in pore waters, as this will allow better estimates of what may be available to biota, and what may be easily remobilized from the sediment. Another informative exercise would be to bring representative samples of these sediments into the laboratory. Relatively simple microcosm experiments would generate data on the actual flux of hydrocarbons out of the sediment and its bioavailability to marine organisms. This information would greatly assist modeling the long-term fate of these compounds in subtidal sediments.

Study #3: Geographic and Temporal Distribution of Dissolved and Particulate Petroleum Hydrocarbons in the Water Column

Summary: This project will analyze volatile aromatic hydrocarbons, TPH by GC and PNA by SIM in water samples already collected at 1,3,5, and 9 depths by a number of groups at "numerous" stations in Prince William Sound, Kenai Fiords and Katmai National Parks. In addition, mussel cages will be deployed at 12 sites in the sound and 18 sites outside the sound to serve as sentinels of water column concentrations of these compounds. Tissue burdens of petroleum compounds will be analyzed in mussels. Additional water samples (including bottom water) will be collected and analyzed as described above at a selected number of sites.

Comments: These parameters need to be measured in water column samples. However, no mention is given in the methods of how or what size of water samples were collected. Due to the low concentrations which would be found in most samples except those taken in the immediate vicinity of the slick, these measurements are very difficult. In order to get really accurate numbers (ie. detectable levels), extremely large volumes (up to many gallons) of water must be collected using clean techniques. In the summary, they speak of determining dissolved and particulate concentrations, yet no mention of this is given in the methods. Due to the high partition coefficients of some of these compounds, it is very important to analyze dissolved and particulate fractions separately. Unless it was clearly specified that all groups had collected water samples in exactly the same way, I would also worry about results being comparable.

Com.	Topic	Issue	Sug.	Sort
30	3	1230		2

Another portion of the water column which seems to have been ignored is the sea surface microlayer. This interface is well known to be a location for locally high concentrations of hydrocarbons. It is also the home of floating eggs and larvae, and a location of photochemical reactions which are likely to alter the chemistry and toxicity of petroleum compounds in this layer.

Use of caged mussels as sentinel organisms is a good idea, but again, evaluation of this portion of the project is hampered by lack of information. How long will the cages be deployed, and at what depths? Hydrocarbon concentrations in mussel tissues tend to be lowest in the late summer just after spawning. Will the same compounds be quantified and mussel tissue and water column samples? How many replicate mussels per cage, and cages per area? There is a large amount of data in the literature on accumulation and depuration of hydrocarbons from caged mussels. Placing caged mussels at so many stations may be unnecessary.

Project #4: Injury to Deep Water (>20 meters) Benthic Infaunal Resources from Petroleum Hydrocarbons

Summary: This study plans to collect benthic samples by Van Veen grab for analysis of community structure at sites (and at the same time) of deep water sediment sampling. Samples will be archived waiting results of sediment analyses, and some undetermined subset would eventually ba analyzed for infaunal species composition, abundance, and biomass. Sediments will also be analyzed using "microbial techniques."

Comments: This study stands out for the lack of information presented. No specifics are given as to the number of grabs per station, nor the level of enumeration to be achieved. The statement about "microbial techniques" is meaningless by itself. Since no information is given about the frequency of sampling it is impossible to say how the results of this study would determine the persistence of injury to benthic resources studied. One of the justifications for this study is that is these species serve as food sources to resource species, and that this study will quantify the extent of contamination of these food resources. Monitoring species composition and biomass will determine if these dietary resources have been destroyed, but unless samples of these organisms are evaluated for hydrocarbon content, it will not be possible to determine the potential for food chain transfer of hydrocarbons from benthic infauna to marine resources.

Once water column concentrations of oil have dissipated. The sediments and infaunal organisms will serve as the long-term source of hydrocarbons to the water column and species resident or migrating through the entire area. Investigation of these processes should not be omitted.

Com.	Topic	Issue	Sug.	Sort
31	2	1240		2

Study #5: Injury to the Air Resource from the Release of Oil-Generated Volatile Organic Compounds

Summary: This study will measure the volatile organic compounds (VOC) concentrations coming off fresh and weathered oil, and model these data into existing air dispersion models and wind vector data to predict what concentrations of VOC would have been over time and space and model toxic exposure probabilities to organisms encountering contaminated air.

Comments: I don't know much about this area, but if the models are accurate they could predict the extent of toxic concentrations in the atmosphere which may have caused injury to any birds and marine mammals which were there at the time. The need for this study to access resource damage does not seem compelling to me. This study would have more utility in predicting atmospheric toxic exposures from future events.

Com.	Topic	Issue	Sug.	Sort
32	3	1250		2

Overall Comments Coastal Habitat Assessment:

Despite the lack of detail in the study descriptions, components of all of these studies are essential to document the extent of oil in the water column and benthos (sediment and organisms) and any immediate changes in populations observed. I would strongly suggest that the number of sites visited could be reduced in favor of more detailed analyses at some of the sites. Continuation of sampling in subsequent years will be essential to determine the long-term impacts, plan remediation strategies, and document recovery. In my opinion, the additional measurements and experiments suggested would help to better

Com.	Topic	Issue	Sug.	Sort
34	3	1100		2

document effects of oil on the habitats and provide information that could be used to model and predict the fate and effects of oil in these areas.

FISH/SHELLFISH INJURY ASSESSMENT

Overall goals:

Each species was evaluated as a separate resource with species selection based on value as an indicator organism or role in major fisheries. For each resource evaluated, abundance and mortality of larvae, juveniles, and adults in oiled and non-oiled areas was assessed. Through the use of the Technical Services Program, tissue concentrations of petroleum hydrocarbons in resource species in some of these studies will also be evaluated.

These studies will be reviewed in groups containing all studies related to a particular species, or studies related to similar species. Each study in the group will be briefly described, followed by comments on the entire group.

Study #1: Injury to Salmon Spawning Areas in Prince William Sound

This portion will visually inspect all known spawning streams in the Sound directly affected by oil, photograph each area and document the extent of oiling including penetration of oil into the substrate. Approximately 100 streams will be surveyed by counting numbers of live and dead salmon by species, location in river, stage of spawning, evidence of prespawning mortality, tide stage and visibility.

Com.	Topic	Issue	Sug.	Sort
35	D	1310		2

Study #2: Injury to Salmon Eggs and Preemergent Fry in Prince William Sound

Forty-six of the streams studied in #1 will be selected for preemergent fry studies. Historical data is available on approximately half of these streams. In each stream 4 zones upstream will be samples for numbers of live and dead eggs and live and dead preemergent fry by species. This will be done 2 times in April and once in autumn.

Com.	Topic	Issue	Sug.	Sort
36	D	1320		2

Study #3: Salmon Coded-Wire Tag Studies in Prince William Sound

Salmon fry or smolt will be tagged prior to release from five hatcheries in the Sound. Two of which received heavy oiling. Marine abundance, survival and harvest of tagged fish will be assessed, as well as the extent of straying of returning salmon into outlying areas.

Com.	Topic	Issue	Sug.	Sort
37	D	1330		2

Study #4: Early Marine Salmon Injury Assessment in Prince William Sound

This study will evaluate some of the tagged fish from Study #3 collected at various points as they migrate through oiled areas for tissue hydrocarbon content and histopathology. Abundance, growth, feeding habits, and behavior of juvenile salmon from both oiled and un-oiled areas will also be assessed. Any fish kills observed will be documented. Pairwise comparison between oiled and control areas will be made for all parameters measured.

Com.	Topic	Issue	Sug.	Sort
38	D	1340		2

Study #7:Injury to Pink/Chum Salmon Spawning Areas Outside Prince William Sound

Numbers and locations and species of live and dead spawning salmon will be determined in at least 4 locations in 109 streams outside Prince William Sound where historical information on fry density is available.

Com.	Topic	Issue	Sug.	Sort
39	0	1370		2

Study #8: Injury to Pink and Chum Salmon Egg and Preemergent Fry in Areas Outside Prince William Sound

Preemergent fry and egg sampling will be done in the fall and spring (Spring, 1990?). Counts of live and dead eggs and fry by species will be done at each of 10 digs at 4 locations in each stream studied. All 109 streams will be assessed for preemergent fry and approximately 80 steams examined for eggs.

Com.	Topic	Issue	Sug.	Sort
40	0	1380		2

Study #9: Early Marine Salmon Injury Assessment for the Kenai Peninsula and Kodiak/Shelikof Strait

This study will repeat many of the measurements made in Study 4 on juvenile salmon in locations more distant from the site of the oil spill, but which were impacted by the slick at a later date.

Com.	Topic	Issue	Sug.	Sort
41	0	1390		2

Comments Studies #1-4:

Together these studies will generate a picture of the how badly the salmon spawning habitat was affected by oil, the impact on eggs and fry, and the success and relative health of this year's crop of released fry and smolt as well as their exposure to petroleum hydrocarbons. Portions of the study should be continued to document re-capture of tagged fish returning from the ocean in subsequent years to quantify any long-term effects of the spill on these species. Again, the number of sites to be studied seems excessive. Certainly a good picture of the effect of oil on spawning salmon and their eggs and fry could be documented with many fewer sites.

Com.	Topic	Issue	Sug.	Sort
42	3	1300		2

Comments Studies #7-9:

These studies repeat in lesser detail some of the work done on salmon species within Prince William Sound. As these fisheries probably were exposed to oil of different concentration and composition from that experienced in the Sound, their study seems justified in the complete assessment of the effects of the spill to fisheries in the area. Once again, the number of sites seems excessive, and to really document effects on these fisheries, some areas should be revisited in subsequent years.

Com.	Topic	Issue	Sug.	Sort
43	3	1300		2

Study #5: Injury to Dolly Varden Char and Cutthroat Trout in Prince William Sound

This study will investigate the effects of the spill on two recreational fisheries species with fairly narrow habitat ranges utilizing streams and lakes which communicate with the Sound. These species migrate annually in and out of overwintering lakes down streams into the estuary to feed, and then migrate back again. Weirs will be placed on four streams to catch and tag individuals from the spring emigration. All fish caught will be counted. Weirs will be placed on two additional oiled and un-oiled rivers to count all

Com.	Topic	Issue	Sug.	Sort
44	0	1350		2

smolting, overwintering and spawning Dolly Varden char and cutthroat trout. Two of these streams have oiled estuaries, two do not. Survival of the tagged fish will be assessed through the capture of tagged fish in the recreational fishery described in Study #6 and recapture in this study (no date given).

Study #10:Injury to Dolly Varden Char and Sockeye Salmon in the Lower Kenai Peninsula

This study basically expands the work done on Dolly Varden char in the Sound as part of Study #5 to four areas in the Lower Kenai Peninsula (2 oiled and 2 control). Sockeye salmon are also found at two of these sites.

Comments: Compared to the salmon studies, this one seems much more manageable. Pairwise comparisons will be made between replicate oiled and un-oiled stream/estuary systems. Although the fate of some of the tagged fish will be assessed as part of the Sport Fishery Harvest Effort (Study #6), it would also make sense to place weirs on the river to document the number of fish (both tagged and untagged) returning to the lakes to overwinter. These fish will have spent the summer feeding in areas impacted by oil, and therefore should best demonstrate any effects. Samples of fish on both the downstream and upstream migration would be taken for hydrocarbon analysis and histopathology. Measurements should also be taken of length and weight to document any sublethal effects of oil on growth during the summer feeding period.

Com.	Topic	Issue	Sug.	Sort
45	3	1400		2

Study #6: Prince William Sound and Gulf of Alaska Sport Fishery Harvest and Effort

This study will survey the sport fishery harvest of salmon, rockfish, halibut, cutthroat trout, and Dolly Varden char by interviewing anglers from 7 locations from May 1 through September 15. Information on the sport catch from anglers using sea planes will be obtained through logbooks maintained by fishing guides. Some fish caught will be examined for (visual I presume) signs of oil contamination. Although not stated, I would assume the study would document the location of capture of tagged fish.

Comments: By comparison with historical data on the sport fishery catch, this information should determine whether or not in the first season post spill sport fisheries have been affected. This project should generate information directly applicable to the impact of the spill on sport fisheries, should relatively cheaply gather information on fish abundance independent to that collected directly as part of this study, and by involving the sport fishing populace should generate public enthusiasm for the restoration efforts.

Com.	Topic	Issue	Sug.	Sort
46	1	1360		2

Study #11: Injury to Prince William Sound Herring

Spawn deposition surveys will be conducted in up to 160 randomly selected transects through areas of herring spawn by divers and non-size selective harvesting of spawning adults. This information will be used to estimate herring abundance, egg densities, spawning bed dimensions and fecundity. The ratio of live to dead herring eggs in oiled and non-oiled areas will be assessed every four days until hatching. Eggs will be collected for hydrocarbon analysis. 180 batches of spawn collected from oiled and non-oiled

Com.	Topic	Issue	Sug.	Sort
47	0	1410		2

areas will be reared in the laboratory where survival of eggs, larvae, size, weight and presence of visible abnormalities will be assessed. Data will be compared with historical information.

Study #12: Injury Assessment to Kodiak and Alaska Peninsula Herring

This study appears to repeat some of the work done in Study #12 in two other areas. Laboratory exposures will be conducted to experimentally determine the lethal and sublethal effects of oil on herring eggs, larvae and adults. Data collected from the field will be compared with historical information.

Comments on Studies #11 & 12: Studies #11 & 12 are aimed primarily at determining the effect of oil on fecundity and survival of herring in and outside of the Sound. Study #11 appears to be a comprehensive approach to assessing abundance and reproductive success in this species. 160 transects seems excessive, but no information is given on the size of the area to be surveyed. Study #12 is extremely vague about what will actually be done, but it appears that different kinds of laboratory investigations will be conducted in these two studies. Better integration is clearly warranted. The effects of water soluble fractions of oil on fish larvae have been well studied by others. Repeating these as part of this study does not seem appropriate.

Com.	Topic	Issue	Sug.	Sort
48	3	1410		2

Com.	Topic	Issue	Sug.	Sort
49	3	1420		2

Study #17: Injury to Prince William Sound Rockfish

This study will assess rockfish populations at 10 reefs in the Sound (6 oiled, 4 non-oiled). Fish will be collected with long-line gear in May and again in August and tissues from fish collected for hydrocarbon analysis. Live fish collected with hook and line. Dead fish on the surface will also be collected. Dead fish will be necropsied, and live fish sampled for hydrocarbon content. The number and distribution of rockfish collected will be compared with historical surveys.

Study #23: Injury to Rockfish, Halibut, and Lingcod Along the Lower Kenai Peninsula

This study will essentially repeat that described in study #17 at several locations in oiled and non-oiled water in and near Resurrection Bay. The species list investigated will be expanded to include halibut and lingcod. Sites selection will be based on areas known to have supported sport fisheries in these species in 1988.

Comments Studies #17 & 23: These fish occupy a habitat not previously well studied, so their examination is justified. Although not specified, I would assume numbers caught during a standardized fishing effort as well as size and size will be quantified. Fish should also be examined for parasites, oiled stomach contents, and general condition. Efforts should be made to determine the age of the fish caught (otolith analysis). This will determine what proportion of the population is being counted and demonstrate if any age-dependant effects are being observed. Organoleptic testing (taste tests for tainting) for hydrocarbons is proposed in this study. This makes sense as these fish are consumed by humans, and oily taste would lessen their value. Why has organoleptic testing been omitted from the other studies? Regardless, standard hydrocarbon analysis should also be done on these fish. Hydrocarbon

Com.	Topic	Issue	Sug.	Sort
50	3	1470		2

Com.	Topic	Issue	Sug.	Sort
51	3	1480		2

analysis methods used on tissues taken in any of these studies should be comparable.

Study #13: Injury to Prince William Sound Clams

This study will assess populations of clams (cockle, littleneck, clam, and butter clam) at three sites each which received no, moderate and heavy oil contamination. At each site three transects will be set up and clams sampled at seven tidal heights along each transect. Live and recently dead specimens will be collected, identified and counted. At each site an additional transect will be set up to determine numbers of dead shells deposited on the shore. For each species three samples will be collected per transect for hydrocarbon analysis and histopathology. Growth and age estimations will be made on 100 littlenecks collected from each transect at each site. One of the heavily oiled sites will be monitored biweekly from May through September. If sudden changes in the proportion of dead clams appear, all other sites will be revisited at that time. If this does not occur, all sites will be revisited once during the fall. The repeat sampling will be used to monitor growth and relative abundance in young-of-the-year clams.

Study #21: Injury to Clams Outside Prince William Sound

This study repeats the analyses in Study #13 at ten locations in Resurrection Bay, lower Cook Inlet, Kodiak Island/Shelikof Strait, and the Alaska Peninsula. At each location an oiled and a nearby non-oiled beach will be selected. In addition to the species enumerated above, the razor clam will also be investigated. Five of the locations (which ones is not clear) will be revisited to document changes in growth rates and recruitment between oiled and non-oiled beaches.

Study #16: Prince William Sound Oysters

Mortality, growth, condition and hydrocarbon content will be followed monthly from April-September in marked individuals from three oyster farms in the Sound. One was in the spill, one near it, and I presume one was relatively unaffected. Parameters measured will be evaluated with respect to degree of oiling received and historical data from pre-spill years.

Study #25: Injury to Scallop Resources in Kodiak Waters

Mortality, growth, and condition factors of wild pink, spiny, and weathervane scallops at one oiled and one non-oiled site in the Kodiak area will be monitored monthly. Tissue samples for hydrocarbon analysis will be collected every over month following the spill through October.

Comments on Studies #13,21,16,25: The clam studies (#13 & 21) appear to be well designed and should unambiguously document the short-term effects of oil on mortality and growth in 4 different bivalve populations. However, it is not clear from the project description how growth will be documented, nor how examination of growth parameters and the abundance of bivalves two to four years old will give information about temporal changes in growth rates and recruitment between oiled and non-oiled beaches. Condition (although not stated I assume they are referring to a body condition index(volume of soft tissue to total volume of organism)) should also be measured on a subset of

Com.	Topic	Issue	Sug.	Sort
52	3	1430		2

Com.	Topic	Issue	Sug.	Sort
53	3	1510		2

individuals from the clam studies to provide information comparable to that obtained in the other bivalve studies.

Will the bivalves be allowed to depurate (void) their gut contents prior to analysis for hydrocarbons? The presence of hydrocarbons in material in the gut can dramatically alter whole body levels analyzed. There are good arguments for and against depuration. However, the same approach should be used in all studies if comparable information is to be obtained.

Using marked individual the oyster study (#16) should give better information about growth and age dependent mortality. However, care should be taken to adequately assess effects on oysters of different ages (younger ones may be more sensitive). The scallop study (#25) is very poorly defined. One of the justifications for conducting this work is the cooperative mariculture feasibility and demonstration project at Kodiak, yet no further mention is given of assessing scallops from the projects. Following only one oiled and non-oiled site monthly over time seems insufficient. A better design would utilize multiple oiled and non-oiled sites visited less frequently if necessary. Also no mention is given as to how the scallops will be sampled to ensure adequate representation of the area. How will age-dependent mortality be assessed? Considering the relatively large budget assigned to this particular project ($2.2 million), a better study design is certainly warranted.

Com.	Topic	Issue	Sug.	Sort
54	3	1460		2

Com.	Topic	Issue	Sug.	Sort
55	3	1550		2

Study #14: Injury to Prince William Sound Crabs

Levels of hydrocarbons will be measured in Dungeness crab samples collected immediately after the spill and again in the autumn prior to egg hatch at eight sites (4 each oiled and control). Fecundity and egg condition will be determined from examination of the adults. Ovigerous crabs will be held in the laboratory until larval release for estimation of larval production. Similar measurements will be made on brown king crab collected in August. Samples of both species will also be taken for histopathology. Observations will be correlated with leveled of hydrocarbons in the sediments at the location of crab collection as determined in the air-water studies. Incidence of leg loss and abnormalities in shells of newly molted crabs will also be assessed.

Study #22: Injury to Crabs Outside Prince William Sound

This study will repeat the fall sampling on Dungeness crab described in Study #14 at some number of oiled and non-oiled sites in Cook Inlet and near Kodiak Island.

Comments on Studies #14 & 22: Study #14 is very well designed. Comparing hydrocarbon levels in these crabs just post-spill and just prior to spawning will give information about speed of depuration from this species as well as short term effects on the adult and on reproductive success. Since female crabs carry eggs on their pleiopods, adults, eggs and larvae can be examined relatively easily in this species. I would suggest that hydrocarbon content of eggs and larvae also be determined. At relatively little additional cost, this will provide useful information to estimate impacts on larvae (the effects of oil on a number of crab larvae have been well documented) as well as provide more information on potential food chain transfer of hydrocarbons.

Com.	Topic	Issue	Sug.	Sort
56	3	1440		2

Com.	Topic	Issue	Sug.	Sort
57	2	1520		2

Study #22 is very poorly described. Although investigating effects on crab outside the Sound is important, from the description provided in study #22 it's impossible to tell what they are going to do. Since crabs live in intimate content with the sediment and scavenge for food, they should be good long-term indicators of oil remaining in the sediments of these areas. Components of this study should definitely be continued in subsequent years.

Study #15: Injury to Prince William Sound Spot Shrimp

Spot shrimp will be collected from oiled (Unakwik Inlet, Port Wells, Culross Passage) and non-oiled (adjacent to Eleanor, Knight, and Green Island) areas. Catch (in up to 264 pots) will be enumerated by number, weight, size, sexual stage, and fecundity for each species. Samples will be taken for hydrocarbon analysis. A stratified sampling plan by depth and location within oiled areas will allow statistical comparisons between relative abundance, fecundity, stage of egg development, size frequency distribution, sex ratios, species catch composition, and hydrocarbon content to be made.

Com.	Topic	Issue	Sug.	Sort
58	3	1450		2

Comments: This study appears to be well designed. From the information given it's impossible to tell if the sample size is appropriate. If possible, egg hydrocarbon content and survival should be assessed.

Study #18: Prince William Sound Trawl Assessment

This study will assess the bottom fishery within the Sound. Surveys will be conducted from Mid-May to mid-June and again in August enumerating species abundance and collecting otoliths for age determination in primary groundfish species. These surveys will document the abundance of all species of groundfish caught and age class composition for primary species. At eight locations (4 oiled, 4 clean), tissue and organ samples of fish and shellfish will be collected for hydrocarbon analysis and physical injuries, and stomach analysis for tar balls in ground fish.

Study #24: Shellfish and Groundfish Trawl Assessment Outside Prince William Sound

This study will conduct parallel surveys to those conducted in Study #18 in June and August in lower Cook Inlet (Kachemak and Kamishak Bays), bays along the Alaska Peninsula, and coastal waters of the Aleutian Islands. Species abundance and age composition will be determined as described above. Stomach, muscle, liver, and bile samples will be collected and analyzed for indication of exposure to oil and potential reproductive damage.

Com.	Topic	Issue	Sug.	Sort
59	3	1480		2

Com.	Topic	Issue	Sug.	Sort
60	3	1540		2

Comments on Studies #18 & 24: The post-spill survey should determine any immediate impacts of oil on the fisheries of all these species. The fall survey should provide information on missing year classes, and provide a baseline for future impairment of these stocks due to longer-termed effects of the oil. Hydrocarbon levels in tissue would indicate any human risk from consuming these species. There appears to be some discrepancies between the methodology to be used between the two studies. Stomach contents will be analyzed in #18, but not in #24. Study 24 states that it will analyze bile for the presence of PAH metabolites. This is an excellent idea because these species can rapidly metabolize petroleum hydrocarbons. Therefore tissue levels of unmetabolized PNA would not be appreciable unless the fish were

still being exposed to hydrocarbons. No mention of bile analysis is given in study #18. "Biochemical analyses" will be used to assess reproductive damage in the fish caught in study #24. These methods should be clarified. Due to my knowledge there are no "standard" biochemical analyses to assess reproductive damage. Regardless, the same methodologies should be utilized in all fish studies.

Study #19: Injury to Larval Fish in Prince William Sound

Potential damage to larvae in the water column will be assessed in this study. According the draft report, there is virtually no historical data on larval distribution or abundance in Prince William Sound. Larvae will be collected using Tucker trawl nets with 0.5 and 1.0 mm mesh sizes and the MOCKNESS multiple open and closing net system once per month from March through October. Larval densities will be recorded. Although not explicitly mentioned, it appears that for some species, larval size and weight will be recorded.

Comments: This study should generate very useful information about larval resources in the Sound. However, several important factors were either not mentioned or were left out. No specifics are given as to the number of trawls in oil and un-oiled areas or the depths at which larval collections will be made. Abundant or important larvae should be examined for physical deformities, and hydrocarbon content. Nowhere in the entire plan of study have I seen any reference to enumeration of phytoplankton or zooplankton abundance or species distribution. In addition to fish larvae, zooplankton caught in these nets should be enumerated. These species serve are food for many of the larvae, and have been shown to be sensitive to oil. Running small meshed next behind the nets already being towed in this study would also allow enumeration of phytoplankton. Again, for little additional cost another component of the food chain could be assessed in this study.

Com.	Topic	Issue	Sug.	Sort
161	3	1490		2

Study #20: Undersea Observations

Remotely operated vehicles (ROVs) will be used to visually assess the extent of submerged sediment oiling in up to 1,500 m depth in Prince William Sound and the northwestern Gulf of Alaska. These observations will support designation of paired oiled and un-oiled areas for the trawl surveys.

Comments: The utility of using ROVs to locate oiled and un-oiled deep water sites in support of the fisheries surveys is well justified. Actual proof of oiled sediments will be based on the sediment surveys conducted in other sections. Sixty days of ROV time are requested. This seems excessive if they are really being used primarily to support these other studies and not merely to photograph the entire seafloor in Prince William Sound and the northwestern Gulf of Alaska. Documentation of how ROV use will be coordinated with the other studies it is to support should be presented.

Com.	Topic	Issue	Sug.	Sort
62	1	1500		2

Study #26: Injury to Impacts on Sea Urchins off Kodiak Island

Urchins from four oiled and four non-oiled areas off Kodiak Island will be examined. At each site five transects will be surveyed at high tide in September and November during the egg maturation period. Transects will be picked so that at least three traverse kelp beds (prime urchin habitat). At

one meter intervals from mean high water to a depth of 20 m and out to a distance of 3 m of either side of the transect, data will be collected on the numbers of live vs. dead and oiled vs non-oiled kelp. Every urchin encountered will be assessed for viability, sex, diameter and position. Along each transect a random sample of ten mature females will be assessed for roe weight as a proportion of total weight and size. At each sample location, roe from ten random individuals will be taken for histological examination and three random composite samples of ovaries collected for hydrocarbon analysis. In addition, twenty live urchins will be shipped to the laboratory for bioassay of toxicity of oil to urchin larvae.

Comments: Compared to most others, this study was very clearly described. The data collected should give valuable information on direct mortality of adults, reproductive effects on adults, eggs pathology, viability of larvae, and success of young of the year urchins. The hydrocarbon analysis of roe will also help to quantify exposure and help to assess risk of human consumption. Noting the presence of alive and dead and oil and un-oiled kelp will not along help to assess exposure to the urchins, but document direct impact on another important resource, the kelp itself. Assessment of effects on coastal and submerged vegetation and micro- and macroalgae is largely absent from the study plan. In addition to visually noting the presence of oil, samples of kelp should be taken for hydrocarbon analysis.

Com.	Topic	Issue	Sug.	Sort
63	3	1560		2

TECHNICAL SERVICES

Study #1: Hydrocarbon Analytical Support Services and Analysis of Distribution and Weathering of Spilled Oil

This section and the details presented in Appendix A describe the framework under which hydrocarbon analysis will be conducted.

Comments: This component is the most critical of the entire study, as accurate and comparable determination of the quantity and composition of petroleum hydrocarbons in all samples is essential to tying any effects measured to the spill, predicting future effects on biota, and monitoring restoration of the environment through either natural processes or human intervention. This section and the supporting documents in Appendix A indicate that the hydrocarbon analysis will be conducted in an appropriate manner. However, since the QA/QC plan was signed in many cases after many of the samples were collected for this study, one has to wonder whether or not all the steps to ensure the quality and comparability of the analytical measurements will or has been adequately carried out. Results from intercalibration exercises and data on field and analytical blanks should be reported in the documents resulting from this study. The formation of the Analytical Chemistry Group to oversee all these efforts is an excellent idea.

Com	Topic	Issue	Sug.	Sort
64	3	2010		2

Chemical analysis should be comparable between the different studies. Some studies neglected to mention what chemistry would be done, some indicated analyses not mentioned in others. Only in one investigation was the analysis of PNA metabolites discussed. Metabolites should be assessed in all fish sampled for routine hydrocarbon analyses. In the Amoco Cadiz oil spill dibenzothiophenes (sulfur containing aromatic hydrocarbons) were found to be a persistent indicator of oil contamination whereas levels of PNAs were sometimes high even in control samples due to the widespread distribution of

these compounds in the biosphere. Analysis for dibenzothiophenes should be included in the study plan.

Study #2: Histopathology: Examination of Abnormalities in Tissues from Birds, Mammals, Finfish, and Shellfish Exposed to the Spilled Oil

This section and the details presented in Appendix B describe the framework under which examine of tissue samples for histopathology will be conducted.

Comments: Histopathological analysis can give very clear and comparable evidence of the effects of oil on aquatic organisms. The description of the methods and the QA/AC plans sounds adequate, although this is not my area of expertise. However, no mention of exactly how preserved tissues will be sampled is given. More effort should be placed on documenting histopathological responses which may lead to long-term affects such as genetic abnormalities. I would like to note that lack to overt histopathology should not necessarily be taken to mean that the organisms were unaffected.

Com.	Topic	Issue	Sug.	Sort
65	3	2020		2

Study #3: Mapping of Damage Assessment Data and Information

All data will be computerized and maps will be prepared to document the extent of oiling in the area, upon which effects noted can be superimposed.

Comments: The initial maps documenting the extent of oiling of water and shoreline over the entire region will be prepared by June 19, 1989. These will be useful to in development of the Coastal Habitat, and fish and Shellfish assessment studies. Adapting a computerized format to collate and display the information generated by this study is critical to proper evaluation of results and the early identification of trends and areas which will require further study. The initial maps should have been included in the Study Plan. Furthermore, a time-table for generation of subsequent maps and their distribution should be included in the plan.

Com.	Topic	Issue	Sug.	Sort
66	3	2080		2

PART II DEVELOPMENT OF THE RESTORATION PLANS

Comments: Basically all this section says is that a restoration plan will be developed for $500,000. No information is given about the types of strategies which may be considered. It appears that little though has been given to how to approach restoration.

Com.	Topic	Issue	Sug.	Sort
67	2	2110		2

References:

Oil in the Sea, Inputs, Fates and Effects National Research Council, National Academy Press, Washington, D.C. 1985, 601 pp.

Amoco Cadiz, Fates and Effects of the Oil Spill Proceedings of the International Symposium at the Centre Oceanogologique de Bretagne, Brest November 19-22, 1989, Published by the National Center for the Exploration of the Sea, Paris, 1981 881 pp. in France with English abstracts.

The Amoco Cadiz Oil Spill a Preliminary Scientific Report NOAA/EPA Special Report, Edited by Wilmot Hess, August 1978.

COMMENTS AND RESUME

OF

PATRICIA A. LANE, PhD

STATE/FEDERAL NATURAL RESOURCE DAMAGE ASSESSMENT PLAN FOR THE EXXON VALDEZ OIL SPILL AUGUST 1989-PUBLIC REVIEW DRAFT

PLA RESPONSE TO FOUR MAIN POINTS
October 13, 1989

1) IS THERE ENOUGH INFORMATION PRESENTED TO EVALUATE THE PROPOSED STUDIES PROPERLY?

Generally, only brief overviews of each study or sub-study are given. Although it is clear that many of the main environmental components have been identified for study, it is not so clear that the studies are designed well enough to provide the needed information to quantify damages rigorously. In particular, there is very little information given on sampling design and methods of data analysis and interpretation during the post-data collection phase. In most studies in which the quantitative details are not well specified in advance for both pre- and post-data collection study phases, there is a loss of usable information and a waste of time and resources. In PLA's report on environmental effects monitoring (1989a,b), we point out many of these pitfalls and show through an examination of world wide impacts of oil on environmental components, how poor field sampling designs have greatly contributed to the failure to document environmental effects attributable to a wide variety of oil production activities, including spills. These effects were undoubtedly far more significant than those quantified and documented.

Com.	Topic	Issue	Sug.	Sort
68	3	0100		2

The text of the Damage Assessment Plan does not read as if it were written by authors knowledgeable in these areas. This comment applies to both pre- and post-sampling and statistical data analysis, as well as modelling on the population and ecosystem levels. A few sentences are interspersed concerning statistical analyses and modelling but few details are given as to what types of data analyses and ecological models will be used and with what expected results (prediction time frame, accuracy, confidence level, uncertainty level etc.). The fact that the quantification aspects of the assessment were not given more initial attention is extremely worrisome and is expected to affect the final results.

A few general comments:

a) It might be wiser to concentrate on fewer components and use particular species as indicators of damage for a broader group of species than to try to measure everything at such a gross level that all results are poor. At the very least, quantification efforts have to be detailed and rigorous for selected species representative of classes of damage. The existing baseline data for each component were not specified. Had this information been fully specified, it would have been clearer which components would be more useful than others to quantify at the various possible levels of detail. It was unclear if the authors themselves were fully cognizant of the state of the background data sets.

b) There was almost no information on how the assessors were going to translate environmental effects (even if well measured) into economic

damages. This is part of the quantification problem but also the complete lack of an appropriate logic bridge from the ecological to economic areas of concern, as well as the lack of associated field and paper data collection exercises. Logic bridge refers to a set of steps that outline how one proceeds from the environmental measures in the field to estimating loss to a population or habitat. This estimate must take into account not only the short term acute event (such as the death of X number of individuals) but also the damage to the success (size) of the future population because of the loss of reproductive contribution of these individuals (and logically of their lost offspring) to future generations. The logic bridge must then proceed to link the environmental loss to its economic value. The assessment plan does not present a convincing logic bridge, which indicates that the priority was given to obtaining field measurements. Too little attention was paid to whether or not the data would be solid and maximally useful and whether the logic underlying the final damage estimates would be convincing in a legal milieu.

c) Although the use of a Geographic Information System (GIS) to represent the spatially-referenced impacts is commendable, it is only described as a tool to map the valued resources and oiled areas. A GIS is designed to store and manage large spatial data sets and to produce appropriate maps of these data. These functions, however, represent only part of the usefulness of this type of tool. In many cases, these functions may not be cost effective for a particular application. More importantly, if the GIS is "intelligent", that is, can take the spatially-referenced information and subject it to damage assessment functions, including ecological risk analysis, then the GIS can be made into an invaluable tool for achieving the damage assessment objectives. There was no evidence in the Damage Assessment Plan that the GIS would be "intelligent" and fully utilized with state of the art assessment methods. "Intelligence" here is used in the sense of providing more than a map of existing conditions either by 1) incorporating dynamic models of future conditions or by 2) integrating different types of existing information into new types of information and their habitats. For example, if bird populations were mapped in with a GIS, it would be possible to model these populations over time to produce "future maps" of the distribution and abundance of the species of interest and then to estimate longer term damage by calculating change with and without the oil spill to estimate longer term damage. In 2, other types of information (toxicity, physiology, behaviour) could be added to that of direct mortality of a species to illustrate future population size, or habitat damage could be modelled with recovery functions to illustrate how the mapped habitat would change over time.

Essentially, an "intelligent" GIS uses additional models to develop more useful types of information or to link future states to present states. The logic bridge discussed above can also be at least partially, if not wholly, incorporated into the analysis. This type of GIS is costly but would become cost effective in the context of a long term damage assessment plan. For the particular type of damage in Prince William Sound, a long term damage assessment capability is definitely needed.

Com.	Topic	Issue	Sug.	Sort
69	3	2030		2

d) The virtual lack of any detail on the restoration part of the plan also did not inspire confidence. There should have been at least preliminary categories of restoration activities and planning so that when the field and laboratory studies were conducted, preliminary evaluations of feasibility and priority could have been undertaken.

Com.	Topic	Issue	Sug.	Sort
70	2	2000		2

e) The problems identified above indicate to us the haste with which the Damage Assessment Plan was probably assembled and the inherent difficulties in coordinating such a large set of activities under less than ideal conditions. While these comments cannot influence the data collection to date, there are still some things that can be done to insure that the data collected will be analyzed as appropriately as possible in the remaining time before results are generated. These "things" include taking stock of the overall objectives of the program and the array of quantitative techniques that are available to facilitate data analysis and interpretation, including the development of appropriate models where none presently exist. For example, if samples are pooled in particular ways during laboratory analysis, this will preclude some types of statistical analysis. Or if certain measurements are not taken, this lack of information may produce a logic bridge with a few key piers missing. As much as possible, any part of ongoing procedures should be improved to maximize the usefulness and reliability of the results to develop the long term damage assessment capability. Specifically, it would be desirable for all data to be placed in a central data analysis centre which could be accessed by computer network (normal phone lines) by interested parties. There should be a coordinated effort of the "data analysts" to standardize their "logic bridge or bridges" and formats of data collection, analysis and reporting.

Com.	Topic	Issue	Sug.	Sort
71	3	2000		2

Available software (models, statistical methods, etc.) should be assembled with one or more individuals to assist in their application and interpretation of results. In summary, it is important to coordinate and share resources and to communicate and integrate results among the assessors, as was done during the spill. The degree this coordination is possible and practical, gives a good indication as to how feasible it is to measure community ecosystem response and cumulative effects.

f) Figure 7 in the Damage Assessment Plan lists the use of "Impact Hypotheses" as one of the key steps in the logic bridge. Hypothesis is a word that is frequently used in science but it can have quite a different meaning when employed in impact assessment. Often it is not possible to "test hypotheses" in an impact assessment context, whereas this is possible in a controlled laboratory experiment. It is important to understand the differences and not to promote hypothesis testing when in fact that is not possible. (See P. Lane and Associates Limited 1989a, b).

Com.	Topic	Issue	Sug.	Sort
72	3	0100		2

In summary, we do not believe that the studies are detailed sufficiently. More worrisome than the actual description, which can best be portrayed as a fairly superficial "measure everything" approach, is the lack of

evidence as to how the data will be integrated and analyzed in a rigorous, quantitative way to provide definite estimates of damage regardless of whether or not a GIS is used. Most of the environmental studies are organized on a per species basis. Whereas much of the damage assessment must focus on a per species basis, it will not be possible to simply add up damage caused to many populations and obtain a measure of "ecosystem damage on cumulative effects" for the Prince William Sound area.

In an ecological system, a change in one component can lead to changes in other components. Analysis of single populations precludes a rigorous delineation of indirect effects and effects of foodwebs. In addition, several pathways of effect can exhibit feedback relationships to populations of interest so that damage may be multiplicative, not simply additive. For example, 8 x 10 = 80 units of damage not 8 + 10 = 18 units of damage.

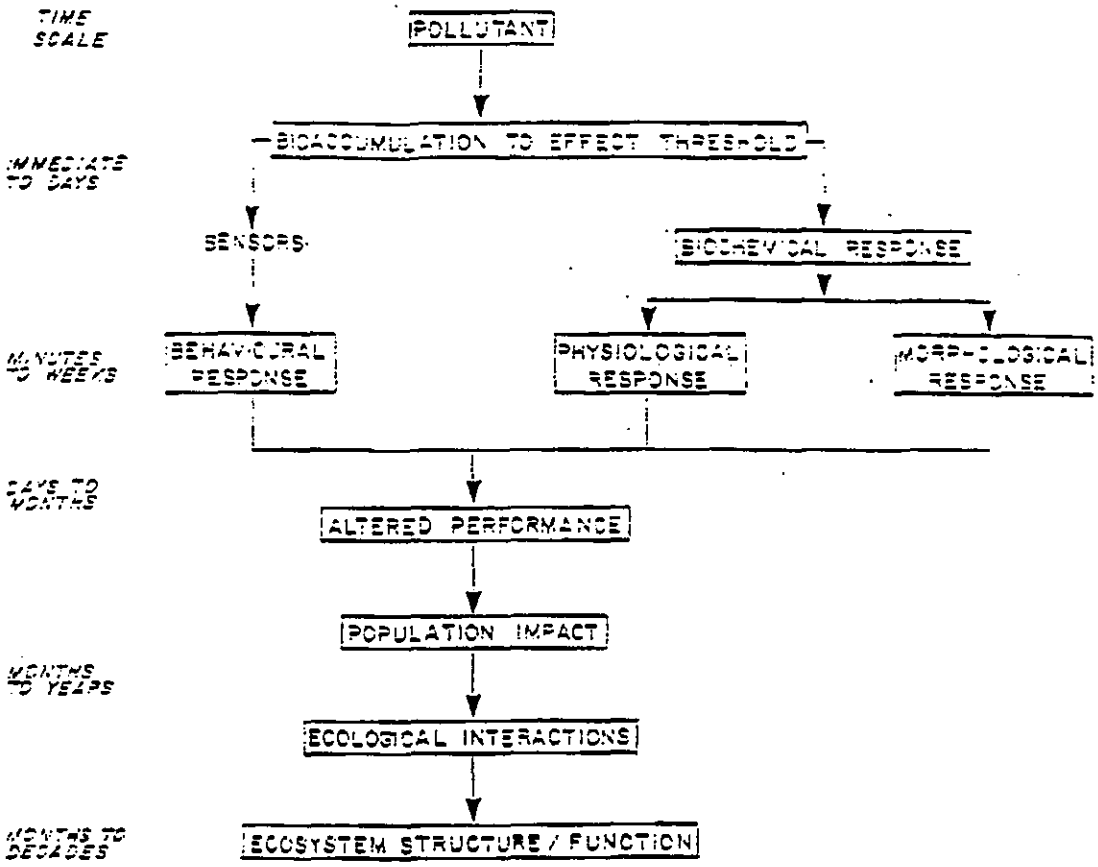
Methodologies given in Lane et al. (1988) for cumulative impact analysis give an overview of methods available to form an integrated cumulative effects assessment process for extended space (longer than local ecosystem) and time scales (longer than one year). This process undoubtedly will be the framework for understanding the damage to the soil and subsequent recovery of Prince William Sound. A cumulative effects assessment and management process should be an integral part of the management of Prince William Sound for the next several years, if not the next several decades.

2) WILL THE PROPOSED STUDIES (BASED UPON A COMMITMENT TO FEBRUARY 1990) PROVIDE A BASIS FOR PREDICTING LONG-TERM EFFECTS; IF NOT, WHAT STUDIES SHOULD BE INCLUDED TO DO THIS?

As the attached Figure 1.1(PLA, 1989a) illustrates, a variety of sublethal, subpopulation effects can impact a population months to years after the original contaminant release. At the population level all of these types of changes would be reflected in altered age-specific fecundity and survivorship schedules(See P. Lane and Associates Limited, 1985). Such a release can also have immediate impact on population through direct mortality following contaminant release. This direct mortality is quantifiable depending on the species, available field data and resources etc. However, the loss of those animals may well be more important in terms of their reproductive contribution to future generations than is the immediate loss of x individuals.

Com.	Topic	Issue	Sug.	Sort
73	3	0201		2

To be meaningful, long term effects much include both direct and indirect causes of mortality from the death of individuals as well as from lowered fecundity and survivorship of age classes. If this is not computed correctly, mortality can be underestimated by many fold. For example, a study of direct mortality might result in the recording of the death of a single individual, whereas a study that includes measures of indirect mortality could conclude that the loss of this individual from the population would result in the loss of 5 - 100 individuals in future generations. In addition, individuals living in very small populations may have trouble finding mates or receiving appropriate behavioral cues and other learning experiences needed for reproduction and survival. Small



Source: after Gesamp (1980) and Scope (1984).

SCHEMATIC DIAGRAM OF THE EFFECTS AT DIFFERENT LEVELS OF THE BIOLOGICAL HIERARCHY AFTER INTRODUCTION OF POLLUTANT INTO THE ENVIRONMENT

populations are also more vulnerable to chance events and therefore have a much higher probability of extinction.

All natural populations exist in ecosystems and although many key populations are of interest because of their direct commercial value, studying these populations in isolation usually will not produce a true representation of total environmental deterioration. Many populations are predators, competitors, or prey in regard to their interactions with other species in the terrestrial and marine foodwebs that exist in and around Prince William Sound. Indirect changes will come about not only from the sublethal and life history changes in the individual populations that inhabit the ecosystems, but also from the altered ecological interactions and foodwebs. A predator population can decline not only from the direct effects of oiled feathers or ingested oil, but also from the lack of a critical prey species that was killed previously by the oil spill. There is no evidence that an ecosystem approach will be taken to examine and quantify foodweb effects related to the oil spill. This is exceedingly unfortunate for two reasons. First, from an ecological point of view, in the final analysis it is the long-term persistence of the ecosystems of the planet that are of main concern, not just the few species that are associated with direct monetary benefits today. Secondly, focus on populations gives too narrow a definition of damage and must a priori lead to further underestimates in damage assessment. See P. Lane and Associates(1985) for an illustration of both population and ecosystem level risk analysis. Thus, if the guilty party were made to pay only for the number of birds or mammals directly killed by the oil spill, based for example upon a carcass count, the amount of true damage could be underestimated by orders of magnitude.

Long term damage is undoubtedly the most important in terms of both total amount of damage and in terms of ecosystem viability. The only way that long term damage can be assessed is through the wise use at both the population and ecosystem levels of appropriate models that would predict possible levels of effects over at least two-three generation periods of the longest-lived members of the ecosystem. Such models are described in PLA (1985) and Lane et al. (1988). Because of the uncertainty of long term predictions, the modelling tool should be able to handle various levels of uncertainty and to be corrected, based on further monitoring data. This particular oil spill will probably be visible for decades. There is no humanly possible way to assess total or long term damage based on data collected within a one year period following the spill. It is possible, however, within this time period, to develop the monitoring systems, the quantitative methodologies and other tools (GIS), the data baselines and an overall plan of damage assessment. In Lane et al. (1987) and Crowell and Lane (1988) we show how a ten minute spill of oil dispersant (Corexit 9527) and oil plus dispersant (each approximately one millimetre thick) produced environmental effects over two subsequent years. These effects included not only ecological measures such as population abundances and distribution of the dominant saltmarsh grasses, but also morphological, physiological and reproductive effects. Plans are underway to study the effects and damage of these miniature controlled spills in the fourth year of saltmarsh recovery.

It is unconscionable to terminate data collection and assessment at such a premature point (one year) when perhaps less than 10-20% of the total damage has been observable or quantifiable. There should permanent monitoring sites with a variety of data gathered, similar to the saltmarsh experiments but extended for a variety of ecosystems. A variety of measurements should be undertaken as illustrated in Lane et al. (1987) and community recovery and recolonization of selected biota should be measured on a continuing basis over a period of several years.

4)ARE THERE OTHER IMPORTANT GAPS IN THE STUDIES PROPOSED?

Several important gaps in the studies have already been mentioned:

1) Lack of Quantitative Rigor

-both short and long term calculations
-field and laboratory designs
-statistical methods and validity of assumptions
-modelling methods, especially ecological risk analysis
-turning environmental results into economic measures

2) Little Evidence of Strong Logic Bridges (necessary to document cause and effect in regard to the following):

-relationships between individuals and populations and between populations and ecosystems
-relationships between terrestrial and marine ecosystems
-relationships between laboratory data (toxicity tests) and population and ecosystem effects
-relationships between various time scales of effects in regard to generation times and time scales of other ecological events
-relationships between sublethal and lethal effects
-role and significance of habitat versus pure biological damage of an individual, population or ecosystem
-relation between environment and economy in a sustainable development context
-relationships between various spatial scales of effects in regard to the spatial patterns of the habitat types (this could be partially resolved with an intelligent GIS)

3) Cumulative Effects Assessment and Management-Sustainable Development

Cumulative effects result in large scale, regional patterns of environmental deterioration. Sometimes they come about from the "tyranny of small decisions" of many different human activities, each small in itself, over an extended ecosystem; sometimes cumulative effects arise from the multiple activities related to a large development; or in the case of Prince William Sound, cumulative effects arise from a catastrophic event. Examples of cumulative effects include global warming and climate change, acid deposition, habitat fragmentation and alienation, pollution of receiving environments, losses in soil quality and quantity, pollution of large aquifers, loss of biological diversity

Com.	Topic	Issue	Sug.	Sort
74	3	0111		2

etc. Recently P. Lane and Associates Limited(1988) have defined and categorized cumulative effects and methodologies for assessing and managing them. If we fail to have sustainable development on this planet, it will be because we have not been able to identify, prevent and reverse cumulative effects.

The Valdez oil spill has endangered the sustainable nature of the Prince William Sound ecosystems substantially. To understand and quantify this endangerment to sustainable development a cumulative effects analysis should be undertaken. Nowhere in the Damage Assessment Plan was this suggested. Unfortunately, cumulative effects are not just additive; they may also be multiplicative. To the degree that they are multiplicative and interacting, damage may again be greatly underestimated. For this type of a cumulative effects problem, the analysis should be based upon an "intelligent" GIS with appropriate environment-economic models to predict endangerment to sustainable development indicators.

APPENDIX A:
Detailed Notes on Some of the Component Studies

Comments on each component area generally reflect (i) a lack of background information that would enable the "public" to determine if sufficient studies were planned and carried out, and (ii) the inadequacy of a one year sampling program for assessing environmental damage.

1) COASTAL HABITATS Study #1, Phase 1: The affected coastline is to be categorized into five "representative" habitat types. What are the different types and how were they chosen? We believe they used existing coastal morphology schemes, but no references or details were given. Up to 150 sampling sites are to be chosen:

5 habitat types X 3 geographic regions X 3 degrees of oiling X 3 replicates

+ 15 more sites that were either lightly-, or moderately to heavily-oiled.

The statistical design is supposed to allow extrapolation of collected information to the entire affected area. With so many sites and the short time period available for study, it is very unlikely the data can be extrapolated to all other locations. Large and rapid seasonal changes in physical, chemical and biological variables in the sub-Arctic place severe constraints on the sampling program. Unless the data collection is carried out in a synoptic-fashion, comparisons to other sites, and between oiled and non-oiled sites are simply not valid. Lacking pre-spill data on most of these sites, it's also unrealistic to assess oiling-damage. Since there are some data available from the Valdez area (refs not given), why not concentrate on the few (?) sites that have some "history" and do less-comprehensive studies on under-represented coastal habitat types.

Com.	Topic	Issue	Sug.	Sort
75	3	1100		2

Phase 2: This part of the study purports to assess changes in "critical" trophic levels and interactions. Who decides what is "critical?" Secondly, how do they expect to determine whether changes in population biomass and productivity, community diversity, vigour and utility to other trophic levels are due to oiling without seasonal, annual, or pre-spill data? Can rate of recovery of these habitats be determined for short-term data collections? They also plan to "kill more animals" by doing on-site amphipod LC_{50} bioassays - is this really necessary?

2) AIR/WATER RESOURCES Study #1 - Floating Oil: This study is useful in that it actually confirms that oil slicks, etc., come from the EXXON VALDEZ, and monitors the spread of floating oil over time. All the analyses will take some time to complete and consequently this delay sets back other studies waiting for this information to plan their sampling projects.

Com.	Topic	Issue	Sug.	Sort
76	1	1210		2

Study #2 - Oil in Subtidal Sediments: Again useful for other studies, but lacking hard data from Study #1, any models projected for oil spill movement will really be guesses. A lot of sediment samples (and analysis time) may be taken

Com.	Topic	Issue	Sug.	Sort
77	3	1200		2

from sites where projected likelihood of oil contamination was high, but received no oil.

Study #3 - Oil in the Water Column: Necessary data, but time consuming taking all of the vertical profiles in relatively shallow (well-mixed) waters. Mussel cages deployed at 12 sites in the Sound, and 18 outside, should be useful for long-term indications of water quality. However, the mussels are transplants from control sites in southeast Alaska - unknown influence on the results?

Com.	Topic	Issue	Sug.	Sort
78	3	1230		2

Study #4 - Injury to Benthic Infauna: As mentioned in the report, many of the samples taken will be archived pending receipt of subtidal oil data (see Study #2 and Technical Services Study #1). Time is an important constraint here.

Com.	Topic	Issue	Sug.	Sort
79	5	1240		2

Study #5 - Volatile Organic Carbon Release: VOC to be measured and along with air dispersion models (wind data required) used to reconstruct ambient VOC concentrations throughout the Sound over time. Prediction of "unhealthful" conditions (to humans) may tell us if terrestrial and marine animals were in any danger. Model loss rates also to be used in mass balance calculations on the fate of spilled oil - utility ??

Com.	Topic	Issue	Sug.	Sort
80	5	1250		2

3) FISH/SHELLFISH We have reviewed the 26 Fish/Shellfish studies (p. 48-111) and, in general, cannot recommend that the Feb 28, 1990 deadline is sufficient to assess the damage caused by the Exxon Valdez oil spill.

The 26 studies proposed are generally inadequate for predicting long-term effects on fish/shellfish populations. It is our opinion that these studies are better suited for estimating the short-term and acute effects of the spill.

Com.	Topic	Issue	Sug.	Sort
81	3	0201		2

We would suggest as a minimum requirement to assess the long-term effects of the spill that the time period be considerably extended for numerous studies. In single species studies, the minimal time period we would recommend would be equal to the average longevity of individuals of that species. This would allow following affected age classes till their demise.

Major gaps exist in the assessment in our opinion. There is no investigation into the sublethal and long-term effects (or delayed manifestations) on individuals or the duration of the damage by the oil spill. Behavioral avoidance studies have been neglected, as have effects of early exposure to oil studies and micro-habitat studies.

Com.	Topic	Issue	Sug.	Sort
82	3	1300		2

Furthermore, the approach taken has been an instantaneous examination of commercially important species only. Little, if any, attention has been focused on a community response approach. It is important to examine the food web that commercially important species are part of, along with such processes as bio-accumulation and bio-retention. The proposed short time frame precludes this. Study of the fish foodweb should be undertaken backed by loop analysis, a qualitative modelling tool. Foodweb structures before and after the spill could be compared supported by toxicity and habitat studies over a period of several years. It is also possible to determine a set of stability measures using loop analysis.

Considering the vast area contaminated by oil, both in the Sound and beyond, we find the proposed study design too limited. Some studies suggest less than 10 sampling sites for the whole area. We recommend a much greater amount of testing both in the Sound and beyond, at numerous sites with varying concentrations of oil contamination (not just 'oiled' and 'non-oiled').

We also recommend that greater attention be given to statistical analyses. Samples should be collected minimally in triplicate. This would allow for estimation of variance at sites.

Many of the proposed statistical analyses are dubious due to the over use of ANOVA. Although surprisingly robust, the Analysis of Variance (ANOVA) is still limited to the analysis of monotypic data and has frequently been revealed as inappropriate for sigmoidal relationships of toxicity curves or the skewed bell shape of habitat preference curves. Other statistical analyses might perform these analyses better, such as non-parametric and multi-variate statistics.

Com.	Topic	Issue	Sug.	Sort
83	3	1300		2

Numerous studies make use of hydrocarbon testing. Methods suggested may result in underestimating contamination. Sampling numerous individuals (15+) representative of each age/size class would allow better regressions. Composite samples should be avoided.

Finally, we are uneasy with the use of such phrases as 'standard methods' and 'representative sample' that appear in some studies. Of even greater concern is the lack of quoting sample sizes or number of sample sites by some studies and the absence of the rationale for deciding the sample size used.

Com.	Topic	Issue	Sug.	Sort
84	2	1300		2

Notes on 26 Fish/Shellfish Studies

Study #1 - What are "aerially surveyed index streams?"

If they are aerially surveyed streams for salmon abundance for how long have they been surveyed? (how many years?)

Historical data must be corrected for timing climate, harvest recruitment, and water levels

Damage estimates of the loss of habitat would have to be estimated annually at least until the progeny of 1989 spawners return, which would be approximately autumn of 1994. This would help account for changes in imprinting, degradation of oil, changes in microhabitat preference and unpredicted effects.

There is no mention of microhabitat studies to determine if redd mating females avoid lightly oiled areas or are less effective in making redds in oiled areas.

Suitable control sites may not exist in the Sound as salmon are highly mobile with keen olfaction; avoidance may be for the general area.

Com.	Topic	Issue	Sug.	Sort
85	3	1310		2

No mention was made of sublethal effects of oil on adult spawners such as:

1) confusion of olfactory senses
   - needed for navigation to some degree
   - needed for avoidance of mammalian predators such as bears (supposedly)
2) less effective spawners because a decrease or loss of key reproductive behaviours.

Study #2

- two replicates - two does not say much, if anything

First two weeks of April and last two weeks of April - depending on seasonal timing, are not replicates when we are talking about preemergent fry

1 site/stream 4 zones/site, 1 transect/zone, 10 samples/transect

- suggest numerous sites/stream - as determined by variability of the data!
- incredible potential for bias
- should be repeated at least each and every year including the year that progeny of 1989 adults return and breed

Com.	Topic	Issue	Sug.	Sort
86	3	1320		2

Study #3 - loss in production - directly by exposure
- indirectly by food chain
- indirectly avoidance not just by exposure!

A. Marine survival and harvest of Pink Salmon
   - the use of only three oiled streams and two non-oiled is not adequate - inter-stream variability will be high, hence will need to use more oiled and non-oiled streams
   - should be repeated for two years (1990 and 1991) so both even-year and odd-year runs are sampled

B. Sockeye
   - proposed only two oiled and one non-oiled watersheds
   - why use streams for pink salmon and watersheds for sockeye?
   - sockeye generally live for four years and migrate considerable distances. Examination of available fish during one year is not a good estimate for other 3 age groups.

C. Hatcheries
   - as in natural studies such a short time frame will not adequately predict the actions of unsampled age groups

D. Smolts
   - should be repeated for each age class (0+, 1+, (2+))

E. Straying
   - why only in outlying areas?

Com.	Topic	Issue	Sug.	Sort
87	3	1330		2

This is a multi year study - tagged as fry, recovered as adults - clearly beyond Feb, 1990. Are all fishery projects exempt from this deadline?

Study #4

- may have to leave the Sound for representative samples
- hydro carbon testing study not adequately described; should comprise 15 individuals from each size category for each site

Com.	Topic	Issue	Sug.	Sort
88	3	1340		2

Studies 1-4 are about salmon - pink and sockeye. What about wild populations of chum, chinook and coho?

Study #5

There is no incorporation of straying between streams. Increased amounts of straying will bias results.

No estimate of reduced fecundity or viability due to oil exposure.

Are the trout in the area breeding after one sea summer? In some places they breed after 2-3 summers in the sea. I do not know about these popins.

2 oiled weir sites - statistically minimum number should be 3 per condition
2 non oiled weir sites

Com.	Topic	Issue	Sug.	Sort
89	3	1350		2

Study #6

There is no attempt outlined to determine pre-spill harvest, effort, distribution, etc. (except opening statement).

Angler 'perception' may be more important than accounted for.

Com.	Topic	Issue	Sug.	Sort
90	3	1360		1

Study #7

Object to produce catalog - no analysis
Data base for other studies

Com.	Topic	Issue	Sug.	Sort
91	3	1370		1

Study #8 - Repeat of Study #2 but outside Sound - does this study also use oil and non oiled areas

Com.	Topic	Issue	Sug.	Sort
92	3	1380		1

Study #9 - Repeat of study #4 but outside Sound

Com.	Topic	Issue	Sug.	Sort
93	3	1390		1

Study #10 - Repeat of Study #5 but outside Sound - 1 oiled weir site and 1 control weir site only! should be at least 3 and 3

Com.	Topic	Issue	Sug.	Sort
94	3	1400		1

Study #11

There are no studies on what effect exposure to oil at an early age has on later development, fecundity, etc.

Com.	Topic	Issue	Sug.	Sort
95	3	1410		2

This study should be repeated each year until 1989 spawn has an insignificant contribution to the population (6-8 years?)

Study #12 - Same comments as #11
Laboratory work should be validated with a field study

Com.	Topic	Issue	Sug.	Sort
96	3	1420		1

Study #13

Cockle, Littleneck and Butter Clam

Number of quadrants should be determined by variability (currently 7/transect)

Hydrocarbon analysis

"3 samples of specimens" - how many individuals?

Test individual! not as a composite.
Should test numerous individuals size per age class

Com.	Topic	Issue	Sug.	Sort
97	3	1430		2

Growth and Age - why only littleneck?
- monitoring of all sites should be done more often than once in the spring and once in the fall - perhaps monthly
- should also include estimates of growth potential on temperature and contrast with real growth
- what happened to razor clams?
- ANOVA not appropriate unless it can be demonstrated that the relationships are at least monotypic and not either the typical bell shape, or sigmoid that would be expected from these studies!

Study #14 - CRABS
- misuse of ANOVA again
- no mention of long-term effects of exposure on young crabs

Com.	Topic	Issue	Sug.	Sort
98	3	1440		1

Study #15 - SHRIMP
- same comments as #14

Com.	Topic	Issue	Sug.	Sort
99	3	1450		1

Study #16 - OYSTERS
- Hydro-carbon testing and all other aspects of the study should continue for much longer than the six months proposed, especially if oysters are the indicator species as eluded to in the study!! (perhaps 7 years)

Com.	Topic	Issue	Sug.	Sort
100	3	1460		2

Study #17 - ROCKFISH
- Would like to see an estimate of density, growth, age structure of popin - all lacking from proposed study.

Com.	Topic	Issue	Sug.	Sort
101	3	1470		1

Study #18 - TRAWL
- should include growth
- unlikely that fish will live long if ingesting tarballs - result will be an underestimate!

Com.	Topic	Issue	Sug.	Sort
102	3	1480		2

- the mid-May to mid-June and the August trawl will not identify missing age groups less than recruitment age unless non-commercial gear is used
- suggest repeating the trawls yearly for ~5 years

Com.	Topic	Issue	Sug.	Sort
103	3	1490		1

Study #19 - LARVAL FISH
- should not be restricted just to the Sound

Com.	Topic	Issue	Sug.	Sort
104	3	1500		2

Study #20 - UNDERSEA OBSERVATIONS
- this is support for other studies and amounts to spot checks
- what is needed is a system or a grid that maps oil contamination and degree of such for the whole area including beyond the Sound

Com.	Topic	Issue	Sug.	Sort
105	3	1510		2

Study #21 - CLAMS
- similar to study #13 except outside Sound - same comments
- why change of species from littleneck clams to razor clams?
- should be the same as that chosen in 13

Com.	Topic	Issue	Sug.	Sort
106	3	1520		1

Study #22 - CRABS
- same as #14 except outside of Sound
- no mention of # of sites or sample sizes

Com.	Topic	Issue	Sug.	Sort
107	3	1530		1

Study #23 - ROCKFISH
- same as #17 except outside of Sound

Com.	Topic	Issue	Sug.	Sort
108	3	1540		1

Study #24 - TRAUL
- same as #18 except outside of Sound
- this study includes historical data

Com.	Topic	Issue	Sug.	Sort
109	3	1550		1

Study #25 - SCALLOPS
- should be long-term to monitor recovery (continual damage)

Com.	Topic	Issue	Sug.	Sort
110	3	1560		2

Study #26 - SEA URCHIN
- 10 females per transect - very small sample to determine abnormalities!
- no statistical confidence
- 20 sea urchins for a bioassay? - should be 20 animals/conc. plus 20 for control
- reservations about ANOVA

7) TECHNICAL SERVICES <u>Study #1 - Hydrocarbon Analysis</u>: With all of the samples to be analyzed (air, water, sediment, and various biota samples and tissues) by a number of laboratories, some defined protocol for sampling, preservation, labelling of the samples, analytical practises, and measures of quality control/assurance must be agreed upon and followed. Coordination by an "Analytical Chemistry Group" will speed up some work but slow down others by adding yet another layer of bureaucracy. Hence it is highly unlikely that all of the samples will be analyzed and checked for inter-lab comparability in the time frame allotted. Only time will tell if adequate precautions were taken and if there were sufficient data to enable assessment of oiling damages.

Com.	Topic	Issue	Sug.	Sort
111	3	2010		2

Study #2 - Histopathology: Necessary, but very time consuming. One can only hope sufficient "control" samples were taken to see the range in various attributes of normal cells and tissues.

Com.	Topic	Issue	Sug.	Sort
112	1	2020		2

Study #3 - Mapping: Supposedly by June 19, 1989, the first map showing oil damage and movement was to be completed. This should have been sent along with the Public Review Draft, along with locations of some of the field sites chosen for the Coastal Habitat Study #1 and Air/Water Studies, and any sites with historical data.

Com.	Topic	Issue	Sug.	Sort
113	3	2039		2

COMMENTS AND RESUME

OF

HOWARD L. SANDERS, PhD

October 26, 1989

COMMENTS OF DR. HOWARD SANDERS, WOODS HOLE OCEANOGRAPHIC INSTITUTE, ON THE DRAFT STATE/FEDERAL NATURAL RESOURCE DAMAGE ASSESSMENT PLAN FOR THE EXXON VALDEZ OIL SPILL (AUGUST 1989)

Sediments serve as the ultimate sinks for oil spilled or leaked into the water column. A not very extensive review of the literature revealed more than 30 citations documenting this very general phenomenon for a wide variety of crude oils and refined products. Findings from some of the more readily available papers are summarized in Attachment A. Some or all of these findings may well be germane and critically important to an understanding of the EXXON VALDEZ Oil Spill and spills generally. The incorporation of these processes into the study program offers a unique opportunity to make a highly appropriate and major contribution to the overall research program.

Com.	Topic	Issue	Sug.	Sort
114	3	0100		2

Com.	Topic	Issue	Sug.	Sort
114	0	1200		2

The relatively enclosed Prince William Sound is not a high energy, open ocean, coastal environment. The seafloor at depths of 20 or more meters in the Sound and fjords that project inland along the periphery of the coastline, to a major extent, are low energy, depositional habitats or "sinks" of fine-grained sediment composed primarily of silt- and clay-sized particles and an ample percentage of organic carbon. Under normal conditions, such depositional habitats have a lower oxygen content of water at the sediment-water interface and within the interstitial water of the upper oxidized sediment largely relative to higher energy sediment habitats. A highly probable response to the unusually large and potentially disastrous EXXON VALDEZ oil is that the "...Oil is likely to move

deeper into the fjords rather than being flushed out. In general, this results in the oiling of increasingly sensitive environments, since the higher-risk, lower-energy environments are located deeper in the fjords and bays..." [See page 13, second paragraph, Public Review Draft.]

What, then, might we expect in regard to possible impacts to the Prince William Sound seafloor and its associated marine life from the massive spillage of Alaska North Slope crude oil that poured from the grounded tanker EXXON VALDEZ into Prince William Sound? Benthic infauna and epifauna living in and on the seafloor sediments are the most important accessible food resource available to commercially important stocks of demersal, bottom-dwelling fish stocks and larger invertebrate crustaceans. In Prince William Sound, this would include among others, halibut, pollack, sablefish, Pacific cod, as well as the Tanner crab, king crab, and the sidestripe shrimp that are worth several million dollars annually. [See Fish/Shellfish Study Number 18, pages 91 and 92 of the Public Draft Report.] If, indeed, large concentrations of the highly toxic North Slope crude oil reaches the seafloor, particularly those extensive areas that are composed of fine-grained, low-energy, organically rich, depositional habitats; then the deep-water benthic infauna and epifauna could well be adversely or fatally affected. [See Air/Water Study Number 4, page 44 of the Public Draft Report.] "... A manned submersible will be used in Prince William Sound during the 1989 field season to visually check for oil in bottom sediment." which is now probably over. [See Air/Water Study Number 2, page 40 of Public Draft

Report.] The resulting information that has accrued of sites or locations where North Slope crude oil has reached the Prince William Sound seafloor and entered the sediment, can then be used to establish vitally important sampling benthic stations that can monitor changes in chemical toxicity and successional benthic faunal changes over time at these oiled contaminated sites. The limited published information available on the effects of the EXXON VALDEZ spillage suggests that the Alaska North Slope crude oil may have been damaging or lethal to a significant and, possibly, a major fraction of the marine benthic fauna in the severely impacted western and southwestern areas of Prince William Sound. North Slope crude oil is highly toxic. Approximately 25 percent of the oil is composed of aromatics, "...which are generally considered the most toxic hydrocarbon components." The oil also "...contains significant quantities of toxic metals." [See Page 235, bottom paragraph of the Public Review Draft.] The massiveness of the oil spilled assures that some and, perhaps, a considerable quantity of oil may reach the seafloor and saturate the topmost centimeters of the sediment. Yet, because of the high toxicity of the North Slope crude oil and the sheer magnitude of the oil spill -- a worst case scenario of a major killoff or total eradication of the benthic invertebrates and demersal fish at the more heavily oiled bottoms and a resulting organically overloaded, contaminated, and anoxic seafloor -- may not be an unrealistic possibility. Although, information has accrued "...about the distribution of spilled oil from the EXXON VALDEZ on the water surface and in the intertidal areas of Prince William Sound

and the Gulf of Alaska.... the extent, distribution, and patchiness of oil and oil byproducts on the seafloor is unknown." [See page 96 of the Public Review Draft. (emphasis added)]

It may already be too late to obtain the crucial information on the impacts of the short-lived, volatile, extremely toxic, single-ringed, aromatic hydrocarbons such as benzene and toluene on the flora and fauna in the water column and the depositional sediment habitats that cover most of the Prince William Sound seafloor and its peripheral fjords. Yet, if the pre-spill information on the concentrations of molecular oxygen present in upper oxidized sediment layer and the depth position of the Redox Potential Discontinuity Layer in the sediments are absent or unavailable, it will still be possible to effectively use a post-spill monitoring and assessment program at selected oiled, depositional, sediment stations with different degrees of oil concentrations and different benthic infaunal successional stages at any given period of time. Stations at sediment sites that were not oiled or very minimally oiled in the aftermath of the EXXON VALDEZ oil spill should serve as controls for the oil contaminated sediment stations. Indeed, it has become vitally important to initiate as soon as possible such a monitoring program over time and space with a particular emphasis on samples collected at water depths greater than 15 meters. In addition to the usual standard procedures normally used in taking bottom samples, the processing of the samples, determining the number of species present in a sample, the number of specimens that compose each species, and the percent composition that each species contributes to the total

faunal density, such a program should include both measurements of oxygen content at the sediment-water interface and in the interstitial water of the sediment and determinations of the depth in centimeters of the redox discontinuity layer in the sediment that separates the upper oxygenated from the lower anoxic sulfide sediment. Since the vast majority of the fauna present at the initial stages of succession are small post-larval animals that would readily pass through the standard 1.0 mm screen apertures, screen mesh sizes of .3 mm or less should be used in the processing.

A severe kill of benthic invertebrates on and in the sediment and a lesser kill of their predators, the much larger, more mobile demersal fish associated with the seabottom by the spilt North Slope crude oil has and could bring about a significant organic enrichment in these low-energy, depositional, sedimentary habitats. The elevated concentrations of sedimented organic matter would likely be further augmented by a slowly sinking pulse of enormous numbers of dead, minute zooplankters, larvae of benthic invertebrates, and larval fish that settle onto and then are incorporated into the sediment after these organisms were poisoned in the overlying water column by the toxic crude oil. The much larger, heavier, contaminated carcasses of orders of magnitude fewer pelagic fishes would sink rapidly through the water column onto the bottom.

The organic matter in these depositional environments scavenge the available oxygen molecules from the interstitial pore water present in the upper centimeters of the sediment and at the sediment-water interface. The oxygen uptake by the organic matter provides

the necessary requisite for maintaining the resultant processes of decomposition and decay. After a period of time, the interstitial water and the sediment-water interface, through excessive organic overloading, become devoid or nearly devoid of molecular oxygen. The Redox Potential Discontinuity and the underlying anoxic Sulfuric Layers move upward and the RPDL reaches the sediment surface or may even move entirely out of the sediment into the immediate overlying water.* At that stage, in the absence of molecular oxygen and animal life, the sediment goes totally anaerobic and azoic. At any given time over subsequent periods of alternating upward and downward migrations of the RPDL through the sediment, the depth position of the RPDL serves as a remarkably good indicator both of the available molecular oxygen present in the interstitial water in the uppermost aerobic layer of the sediment and the successional stage of the benthic fauna currently occupying the sediment. This insightful approach can be very effectively used for the ongoing EXXON VALDEZ Oil Spill study. Such an ongoing monitoring program would be most valuable and central to the evaluation of whether the more severely oiled areas of the seafloor have or will become long-term repositories "for hydrocarbon, contributing to chronic toxicity through mobilization of oil into the water column." (See Page 39 of Public Review Draft.)

From the now available Public Review Draft of the State/Federal Natural Resource Damage Assessment plan for the EXXON VALDEZ Oil

Com.	Topic	Issue	Sug.	Sor
143	3	0201		2

* A detailed discussion of the RPDL is included in Attachment B.

Spill itself, it has become clearly evident that pollution impact will almost certainly be long-term and severely damaging. Yet, inexplicably, the Executive branch of the Federal Government has recently decided to fund for only one year the largest and potentially most damaging oil spill in the nation's history of one of the most pristine, wild, and unspoiled ecosystems in North America. Unless this unexplained dichotomy is quickly, effectively, and constructively resolved, the fundamental objectives of the EXXON VALDEZ oil spill studies may well be profoundly compromised. If, indeed, such a scenario is realized, it will confound, distress, anger and antagonize the involved professionals dedicated to the study, the environmental movement within the United States and throughout the world, and a very significant percent of the informed, concerned, and responsible citizenry here and abroad.

Attachment A

In the area of the FLORIDA spill, off West Falmouth, Massachusetts, in Buzzards Bay, the light #2 fuel oil adhered to particulate organic matter and fine sedimentary particles in the water, and rapidly settled to the bottom (Blumer and Sass 1972). There, the oil degraded very slowly, and spread over the bottom, probably in part, by resuspensions months and even years after the spill.

Crude oil from the blowout at the Santa Barbara Platform initially reached the bottom sediments by the same mechanism operative off West Falmouth, and later spread along the bottom to cover much of the floor of the Santa Barbara Basin to water depths of 500 m (Kolpack, 1971). In the aftermath of the spill of heavy Bunker Oil C oil from the ARROW into Chedabucto Bay, Nova Scotia, the petroleum hydrocarbons dispersed widely throughout the water and in the subtidal sediment (Scarratt and Zutko, 1972).

In the massive AMOCO CADIZ spill off Brittany, fine droplets of light crude oil were absorbed by suspended sedimentary particles; a large quantity of oil reached the seafloor within two weeks (Cabioch, Dauvin and Gentil, 1978). Once on the bottom, this oil travelled along the seafloor with the silt (Spooner, 1978, p. 284). Toxic effects of the oil became manifest 90 km from the wreck five days after the spill began.

In the study of the TSESIS spill in the northern Baltic Sea, off Sweden, sediment traps were placed in the water column 20 m below the surface, to measure the quantity of heave #5 fuel oil absorbed on settling organic and sedimentary particles (Johnson, 1979). The #5 fuel oil composed as much as 0.7 percent of the sedimented matter recovered from the traps in the two weeks following the spill. Indeed, further very recent sediment samples collected from muddy, intertidal, fine-grained, depositional study sites revealed the presence of residues of Number 2 fuel oil 20 years after they were heavily oiled in the immediate aftermath of the oil spillage from the barge FLORIDA.

The FLORIDA and ARROW oil spill studies continued for several years. Oil residues from both accidents were still present in some of the bottom sediments a decade after the initial spills.

Oppenheimer, Miget and Kator (GURC/OEI, 1974) found oil residues present in each of eight zooplankton samples collected in the Gulf of Mexico off Louisiana. During the ARROW spill study of Chedabucto Bay, Nova Scotia, it was observed that the zooplankton ingested small globules of oil in the water column. Conover (1971) found that their faecal pellets contained as much as 7 percent Bunker C oil. He calculated that about 20 percent of the oil was sedimented to the bottom as zooplankton feces.

Wiebe, Boyd, and Winget (1976) measured the rate of sinking of zooplankton faecal pellets that sank at an average speed of 171

meters per day at a water temperature of 22° C and 151 meters per day at 5° C.

These three bits of information strongly suggest that zooplankton faecal pellets provide a major and rapid route for transporting oil through the water column to the seafloor at depths of 200 m and shallower.

ATTACHMENT B

An anaerobic sulfide system underlies a covering of oxidized sediment in all aerobic marine subtidal soft-bottom environments [Fenchel and Riedl, 1970]. Interposed between the oxygenated and reduced layers is the narrow, transitional Redox Potential Discontinuity Layer (RPDL) where small amounts of both oxygen and reduced compounds are present. This three-tiered layering pattern is the manifestation of the one-way supply of free oxygen into the sediment at the sediment-water interface. Once in the bottom, the concentration of free oxygen present in the interstitial water of the sediment progressively diminishes with depth until it disappears. The absolute depth of this oxygenated zone is controlled by a number of physical and biological conditions. However, there are two primary conditions, the amount and rate of organic matter imported into the sediment and the concentrations of free oxygen available for degradation. A low rate of organic import and a high availability of oxygen can extend the oxygenated layer as much as 25 or more centimeters below the sediment surface. Alternatively, a high rate of organic import and a low availability of oxygen can limit the aerobic layer to the uppermost few millimeters of sediment or, together with the Redox Potential Discontinuity Layer, it might be entirely displaced as the anaerobic layer pushed upward to the sediment surface.

Other conditions that move the RPDL upward or downward to narrow or broaden, respectively, the aerobic zone include both physical factors such as temperature, particle-size composition of the sediment and storm-generated waves that reach the surficial seabed and biological factors such as intensity of bioturbation and degree of mucus secretion. Conditions that raise the RPDL towards the surface are (1) high temperature; (2) low-energy depositional sediments, with relatively high organic content and predominantly composed of fine-grained silts and clays, that reduce sediment permeability and scavenge available free oxygen; and (3) mucus secretions that bind sediment particles and form a substrate for bacteria. Conversely, conditions that move the RPDL deeper into the sediment are (1) low temperature; (2) high energy, erosional sediment environments with little organic content and largely composed of coarse-grained sands and gravel, that enhance permeability and allow penetration of free oxygen deeper into the porous substratum; (3) storm-generated waves that reach and disturb the underlying seabed and oxygenate the superficial sediments; and (4) bioturbation by benthic infauna through burrowing activity and tube-building that introduce free oxygen into the deeper sediments.

There is now an abundant documentation in regard to organic enrichment that related the depth of the Redox Potential Discontinuity Layer in the sediment to the successional stages of the benthic fauna. There is no attempt here to review the extensive relevant literature. Instead, the reader is referred to the important review article by Pearson and Rosenberg [1978] that provides an excellent synthesis of the subject and some mostly more

recent papers [McCall, 1977; Rhoads, McCall, and Yingst, 1978; Yingst and Rhoads, 1980; Sanders et. al., 1980; Aller, 1980; Rhoads and Boyer, 1982; Larson and Rhoads, 1982] that have added further insightful dimensions to our understanding of this relationship. Benthic faunal succession remains remarkably similar independent of whether it is manifested along a temporal or spatial gradient. Temporal succession occurs in the aftermath of a severe disturbance or perturbation that significantly reduces or eradicates the resident benthic population. Examples include responses to a massive red tide outbreak [Dauer and Simon, 1976; Simon and Dauer, 1977], a deluge from a tropical storm that created near freshwater conditions in shallow water and deoxygenation in deeper water beneath the sharp halocline that was generated [Boesch, Diaz, and Virnstein, 1976], anaerobiosis through accumulations of drifted macroalgae and a covering of blue-green algae [Watling, 1975], dumping of dredge spoils [Rhoads et. al., 1978; Rhoads and Boyer, 1982] and an oil spill [Grassle and Grassle, 1974; Sanders, 1978; Sanders et. al., 1980]. Spatial succession is a response over distance to a chronic source of pollution. Examples, among others, are pulp mill waste [Pearson, 1975; Rosenberg, 1976] and sewage industrial waste [Reish, 1959 and 1971; Wade, Antonio, and Mahon, 1972] discharges. There are, of course, successional or regressional events that have both a temporal and spatial component such as the chronic release of petroleum at an oil rig complex from initiation of operations through the next few years [Addy, Levell, and Hartley, 1978].

The patterns that have emerged as a result of organic enrichment reveal faunal succession over time and space. At very high inputs of organic matter into the seafloor, the anaerobic layer rises to the sediment-water interface, the sediment is laminarly stratified, devoid of a benthic fauna and undisturbed in the absence of bioturbation. When the RPDL is limited within millimeters of the sediment surface, the initial successional stage is present. Its benthic fauna is usually characterized by small opportunistic polychaetes that are either tubiculous or motile and barely infaunal and are members, respectively, of the Families Spionidae and Capitellidae. The vast majority of individuals belong to one or two species (i.e., pronounced numerical dominance). The few pioneer species typically found are confined to the very narrow oxygenated surficial layer and exist under marginal and variable conditions that include low to minimal levels of free oxygen, high concentrations of sulfides and a low pH. These opportunistic species are eurytopic (i.e., wide physiological tolerances) and have broad, zoogeographic distributions. As products of the ephemeral nature of their environment, these resilient opportunistic species are small and rapidly achieve sexual maturity. Yet, this initial successional stage typically has very high numerical abundances that exceed those

that appear in any of the subsequent successional stages.* Because its species are limited to and feed as deposit-feeders from the surficial sediments or as suspension-feeders from the immediately overlying water, the sediment surface becomes pronouncedly pelletized. The fecal pellets, in turn, provide surfaces for microbial activity. Although the benthic faunal biomass of this primary successional stage is small compared to the relatively long-lived, slow-growing, late-maturing and larger macrofauna present in the late successional stages, their brief life spans and the rapid turnover of multiple generations within the course of a single year are indicative of very high rates of annual organic productivity [J.F. Grassle and J.P. Grassle, 1974; McCall, 1977; and Rhoads et. al., 1978] that most likely will exceed production rates realized in later stages. Rhoads et. al. [1978] conclude that the pioneer species in Long Island Sound have individual and population growth rates that are 10 to 100 times higher than the equilibrium species that characterize the late successional stages.

Related to this phenomenon is the remarkably high colonizing potentials of these pioneer species as demonstrated with azoic sediment tray experiments carried out by J.F. Grassle and J.P. Grassle [1974] on an intertidal sediment of fine sand in the Wild Harbor River estuary of Buzzards Bay, Massachusetts and by McCall [1977] on a subtidal sandy silty sand bottom beneath 14 meters of water in Long Island Sound off Connecticut. Grassle and Grassle's study revealed that a density equivalent to more than 400,000 individuals per sq. meter of the polychaete Capitella capitata sensu lato were present after a one month interval. We now know that Capitella capitata is, in reality, a complex of very similar sibling species [J.P. Grassle and J.F. Grassle, 1976; J.F. Grassle and J.P. Grassle, 1977]. More than a single Capitella species colonized the Grassles' sediment trays. One species, Capitella type 1, grows from settlement to maturity in about 30 to 40 days, an adult female produces anywhere from one to several broods and breeding occurs at the study site throughout the year at water temperatures that range

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* Samples collected from this successional stage and then washed through a screen with 1.0 mm-mesh aperture will retain about an order of magnitude fewer specimens -- primarily mature, adult animals -- than would a screen with 0.3 mm-mesh apertures where the smaller postlarval specimens comprise the vastly greater percentage of the total fauna retained on the screen. Clearly the employment of screens having 0.3 mm-mesh apertures are decidedly more relevant and germane for the first and, to a lesser degree, the second successional stages of the benthic invertebrate infauna than for the later successional stages. Yet, 0.3 mm-meshed screen do retain nearly all the postlarvae of most of the species present in the later successional stages. The readily available postlarvae can be effectively used to measure the dynamics of growth in length and dry organic weight over time at selected stations that are sampled on a monthly basis.

from -1.5°C in winter to more than 24°C in summer. In McCall's experimental bottom samples in Long Island Sound, the azoic sediments were immediately colonized. Within ten days, densities of the spionid polychaete Streblospio benedicti and the capitellid polychaete Capitella capitata sensu lato reached 418,315 and 36,120 per sq. meter, respectively [McCall, 1977]. Rhoads et. al. [1978] estimate the Streblospio produces 3 to 4 generations per year in Long Island Sound study site.

As products of the transient nature in time and space of their pioneer stage habitat, the opportunistic species experience very high mortalities as larvae in the plankton and throughout their postlarval benthic life. Their confinement to the oxygenated surficial sediment that may be only millimeters thick deprives them of the refugium of depth. Thus, they are most susceptible to predation by fish, decapod crustaceans, and other epifaunal carnivores.

Species that appear following a severe disturbance that defaunates the benthos, and explosively increase to reach extreme abundances during the first recovery stage and then go into an equally sharp precipitous exponential decline as the initial pioneer stage terminates, are few in number. Yet, most of the benthic fauna present during the initial colonization stage are members of such species. In North America and Europe where the vast majority of the studies on benthic faunal succession have been done [see Table 1 in Pearson and Rosenberg, 1978], this small group of opportunistic species mostly belong to the polychaete families Spionidae and Capitellidae. Species that best characterize this group are Capitella capitata sensu lato, and the spionids, Polydora ligni and Streblospio benedicti along both the Atlantic and Pacific coasts of North America and Capitella capitata sensu lato and the spionids Scolelepis fulginosa and Polydora ligni [=P. ciliata] in European waters. Other species associated with these prime opportunists are present at much lower densities and do not share their 'boom and bust' life history patterns. Unlike the ephemeral opportunists, they display much less temporal variability and usually persist to become members of some of the sequential successional stages where they are often more abundant.

Spionid polychaetes are one of the key colonizers of the pioneer successional stage. They form dense thickets or mattings of closely spaced, small diameter, vertical tubes. Aller [1980] demonstrated that the toxic compounds in the ambient pore water, that diffuse into the tubes from the surrounding reduced subsurface sediment, are flushed from the tubes into the overlying water where oxygenated water from above the tubes is drawn in as replacements. By means of these outflowing and inflowing fluid bioturbating activities and the high density of closely arrayed tubes, the spionid worms collectively are able to maintain adverse solutes such as NH_4^+ or H_2S within their tubes at relatively low and constant levels. However, as a result of these pumping activities, the oxygenated water within the tubes also diffuses out into the surrounding subsurface sediment to stabilize

and deepen the narrow surficial oxygenated layer and thus allow other early successional species to colonize the sediments.

The later successional stages will be dealt with herein in a more cursory and general manner. Yet, sufficient information will be conveyed to provide the necessary frame of reference. For detailed knowledge and information on the later successional stages, the reader is referred to the papers and bibliographies of Pearson and Rosenberg [1976; 1978], Rhoads, McCall and Yingst [1978]; Yingst and Rhoads [1980], Aller [1978; 1980], Aller and Yingst [1980] and Rhoads and Boyer [1982].

Along the progression from the pioneer stage through the sequences of later successional stages, certain general trends become clearly evident. The RPDL migrates deeper into the seafloor, the sedimentary depth occupied by the macrofauna similarly deepens, the feeding mode gradually shifts from surface deposit-feeders and suspension-feeders to preponderantly subsurface deposit-feeders, the maximum size of the macrofauna, the degree of both fluid and particle bioturbation and the structural and ecological complexity of the infaunal assemblage increase. All these trends are intimately interrelated, interdependent, and highly correlated. If the progression of sequential succession from pioneer to equilibrium stage is undisturbed, which may or may not occur, changes in faunal composition will be persistently gradual and nearly continuous rather than disjunct and abrupt, with intervals of arrest and retrogression.

Bioturbation activities such as irrigation by sedentary or relatively sedentary infauna living in tubes, shafts or often deep semi-permanent burrows that connect directly to the sediment surface and random burrowing by errant infauna increase the passage of free oxygen and dissolved nutrients into the sediments and the flushing of deleterious metabolites from the sediment that are orders of magnitude greater than molecular diffusion rates. The manifestations of such activities are the lowering of the RPDL and the enhancement of microbial activity, particularly at the discontinuity layer [Hylleberg, 1975; Aller, 1978; Yingst and Rhoads, 1980; Rhoads and Boyer, 1982].

Intense errant burrowing activity accelerates diffusion rates by increasing water content and homogenizing finer-grained sediments [Rhoads and Boyer, 1982]. Deposit-feeders void ingested sediments as feces in the form of organic-mineral aggregates that may form as much as 70% of the soft sediments [Johnson, 1974]. Such aggregations have two important effects. They significantly increase sediment porosity and thereby facilitate diffusion and the transfer and oxidation of reduced chemicals. Secondly, they enlarge the environmental space available for meio- and macrofauna and provide organic-rich surfaces for bacterial flora.

The deep semi-permanent feeding burrows, characteristic features of the later, mature, successional stages, are usually associated

intimately with the RPDL. The rapid and immediate vertical transfer of well-oxygenated, nutrient-rich water from above the seafloor to the immediate proximity of the RPDL that lines the burrow deep into the anaerobic, sulfidic sediment is brought about by the pumping activity of the burrow occupant, usually a large invertebrate. Such a behavioral strategy bypasses the route of slow diffusion downward through the sediment and the gradual attenuation of oxygen tension with depth. One variant of this pattern is the 'conveyor-belt' deposit-feeder that feeds head down in the sediment as exemplified by maldanid polychaetes as, for example, Clymenella torquata [Rhoads and Stanley, 1965]. In this position, the polychaete progressively 'mines' deeper into the seafloor and selectively ingests the fine sediment patches which are processed in the gut and discharged as unconsolidated feces at the surface. Highly irregular, three-dimensional RPDL-lined water pockets are created by the intense feeding activities of these worms. The pockets, themselves, may protrude deep into the anaerobic zone to form localized aerobic areas. One of the ultimate results of such activities is the markedly increased microbial activity.

An essentially identical feeding pattern exists for a very different invertebrate, the infaunal holothurian echinoderm, Molpadia oolitica [Rhoads and Young, 1971]. Like Clymenella, this sea cucumber lives head down vertically and feeds deep in the underlying sediment often 20 or more centimeters beneath the surface and deposits its unconsolidated feces upward onto the seafloor. Molpadia ingests only the fine-grained particles to create highly convoluted, three-dimensional, RPDL-lined, aerobic voids or feeding pockets at depth within the surrounding unperturbed anaerobic sediment that considerably enhance microbial activity and chemosynthesis. Other feeding strategies have been utilized by deep-dwelling infauna occupying semi-permanent burrows. Hylleberg [1975] applied the term 'gardening' to describe the effects of feeding by the lugworm, Abarenicola pacifica. This polychaete, like other members of the Family Arenicolidae, lives in deep U-shaped burrows. By irrigating its tube, the worm pumps oxygen and nutrients from the overlying water into the feeding pocket. These, together with the animal's own feces, provide the stimulus for microbial growth along the RPDL lining the feeding pocket. The microbes so produced, as well as meiofauna feeding on this rapidly growing flora, serve as the primary food source for the lugworm.

Another example of 'gardening' has been demonstrated by Frey and Howard [1975] for the burrowing shrimp, Upogebia litoralis. This crustacean collects plant material on the sediment surface which it packs along the inner walls of the burrow. Then after incubation it 'harvests' or ingests the bacteria that grow on the plant detritus.

Microbiologists, for more than 32 years have know the Redox Potential Discontinuity Layer to be a site of significant microbial activity [Vishniac and Santer, 1957]. This relationship has been shown both in the water column [Sorokin, 1964; 1965; 1972] and in bottom

sediments [Hayes, 1964; Fenchel and Riedl, 1970; Sorokin, 1
Yingst and Rhoads, 1980]. Thiobacillus bacteria [Vishniac
Santer, 1957], oxidizers of reduced sulfur compounds, and other chemosynthetic bacteria [Fenchel and Riedl, 1970] are especially abundant there. Rhoads and Boyer [1982] observed in the deeply oxygenated sediments of the late successional stages that both errant and sedentary components of the benthic fauna were "... concentrated at, but not limited to the RPDL. The RPDL is in fact related to the feeding depth."

The strong implication that logically flows from these observations is that wherever the RPDL is present, independent of sediment depth or successional stage, it becomes the site of chemosynthetic primary production. Thus chemosynthetic primary production must be an ever present phenomenon in the sediments of eutrophic marine environments that include the shelves and, in part, the continental slopes throughout the World Ocean except under the special conditions discussed earlier that permit the anaerobic zone to rise to the sediment-water interface and thus displace both the RPDL and the upper aerobic layer. The studies cited above that infaunal deposit-feeders concentrate and feed at the RPDL indicate that chemosynthesis, currently unevaluated, may be an important and possibly dominant food source (as compared to photosynthesis) for the infaunal benthos.

COMMENTS AND RESUME

OF

MICHAEL KAVANAUGH, PhD

October 20, 1989

To: Sarah Chasis
From: M. Kavanaugh

Re: Review of State/Federal Natural Resource Assessment Plan for the Exxon Valdez Oil Spill

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This review of the State/Federal Natural Resource Assessment Plan for the Exxon Valdez Oil Spill is limited to the restoration plan and the natural resource damage determination on pages 185 to 202 of the public review draft. The stated purposes of the studies are: (1) to support the development of restoration plans to promote the long-term recovery of the natural resources; and (2) to support the determination of damage claims presented to the responsible parties. An assessment that fulfilled these purposes could provide the trustees (and the public) with a statement of the harm done to nature by this spill and what could be done about it. Unfortunately, the purposes are unlikely to be fulfilled and an opportunity will be missed to assess the spill's damage and to evaluate responses because:

Com.	Topic	Issue	Sug.	Sort
115	3	0100	X	2

* There is a too much emphasis on studies to determine lost use value over studies to develop restoration plans. Analysis of restoring and purchasing equivalent resources elsewhere (restoration) is likely to be as important if not more important than studying lost use values. Determining how much polluters must pay for the restoration of the damaged natural resources is one of the purposes of the calculations. The calculation of use values is relevant for determining that portion of the damage claim to cover the diminution of use during the interim required to achieve restoration. If restoration is impossible, then use value studies take on added importance. But, it cannot be determined in advance that restoration is impossible.

Com.	Topic	Issue	Sug.	Sort
116	4	0201	X	0

* Neither the development of a restoration plan nor the conduct of a credible, professional assessment of the natural resource damages caused by the spill can be completed by February 28, 1990 (the deadline). The deadline may reflect lack of funding (See The Exxon Valdez Oil Spill, A Report to the President, Skinner, S.K. and W.K. Reilly, p.35). Nevertheless the same report calls for long-term...broad gauge, carefully structured...damage assessments (Executive Summary p. ES-2). The deadline may also reflect a desire to complete the assessment early, since the full extent of the damage will never be known

with certainty. Nevertheless, the scope and complexity of the studies plus the need to sequence the studies makes it impossible to complete all of the studies by this winter.

Com.	Topic	Issue	Sug.	Sort
117	3	0151	X	2

* The description of the process to develop a restoration plan is too brief. At a minimum, the plan should contain both restoration and replacement strategies. The restoration strategies should provide estimates of how long the resources will take to recover given alternative levels of clean-up, as well as measures to promote long-term recovery such as requiring all tanker traffic moving through the spill area during the restoration period to move only in daylight hours and be doubled-hauled or have the cargo containerized. The replacement strategies should consider replacement in-place (e.g., breed in captivity) and establishment of an environmental permanent fund to fund long-run efforts to restore the damaged resources or purchase equivalent resources (or the development rights) elsewhere (i.e., acquire and deed to the public resources such as land and shoreline outside of the spill area).

Com.	Topic	Issue	Sug.	
118	3	2200	X	2

* The descriptions of the economic use studies:

- are too brief to allow a thorough review. It is unusual for the government to fund millions of dollars worth of research on the strength of descriptions like those contained in the public review draft. To complete the 9 proposed studies in 10 months means spending on the order of $14,000 per day. Surely, someone has a better idea of how sums of this magnitude are being spent then is revealed in this document.

- show no appreciation of the problems that might be encountered and the special analytical techniques needed to value natural resource losses that:

  -- involve ecological losses for which existing evaluation methodologies are wanting;
  -- may be irreversible;
  -- may not be apparent for a year or more;
  -- may be catastrophic if endangered species are threatened or if there is loss of habitat; and
  -- will be subject to considerable uncertainty.

- contain no discussion of the applicability of existing literature and models. Most studies of tourism losses, for example, count these losses as transfers because there are readily available substitutes for a given polluted beach. There might not be available substitutes for an Alaskan experience and the existing literature and models may be misleading.

- are silent about the choice of a discount rate. The spill and its effects will last many years. This coupled with the potential for irreversible (or extremely long-lasting) damage implies that the spill has transferred resources from future generations to current generations. The discount rate is the analytical parameter that allows inter-temporal comparisons. There is literature suggesting fair representation of future generations requires use of a zero or near zero discount rate. (See, Schulze and Kneese, Risk Analysis, 1981 and Schulze, Brookshire and Sandler, Natural Resources Journal, 1981).

A. Economic uses studies:
   1. price effects;
   2. industry costs; and
   3. bioeconomic models.

Taken as a group and reading between the lines, these studies have the potential to estimate the damages caused by the spill to the commercial fishing industry and their customers during the interval necessary to restore the natural resources to their pre-spill condition. The studies, however, will not measure any degradation in the quality of life suffered by the fishing communities. This degradation can take many forms including increased alcoholism and violence.

The correct measure of the loss to the commercial fishing industry and its customers is loss is the discounted present value of current and future reductions in consumers' plus producers' surplus plus the value of the resources made idle by the spill. (The discount rate should be zero or near-zero to account for the long-term impact of the spill. Surplus refers to the difference between what people are willing-to-pay for a good or service and the amount of resources they have to forego to have the good or service. Analytically, it is the area above the supply curve and beneath the demand curve. The resources made idle by the spill are represented by the area under the supply curve. Measuring surplus requires, (a) defining demand curves for the products of the commercial fisheries in terms of their elasticity of demand, [presumably this is accomplished in #1], (b) describing the supply curves [presumably #2], and (c) estimating the shift in demand and supply curves caused by the spill in current and future years [parts of #2 and #3].)

Since in the first year of the spill almost all of the catch was lost, the measure of damage is the surplus loss plus the opportunity cost of the idled fishing boats and unemployed labor. This estimate is repeated for all subsequent years the spill influences commercial fisheries. The subsequent influence of the spill may take two forms. The first is a supply side effect. The

continued from p. 2

spill may reduce significantly the fish population and require more fishing effort (e.g., boats have to be cleaned more frequently, travel farther to reach fishing grounds, and stay longer to catch a load of fish). Analytically, this is an upward shift in the supply curve. The second is a demand side effect. A stigma may attach to Prince William Sound product for years to come such that wholesalers, retailers and the public will consume Prince William Sound product only if they are offered a price discount. (For example, Prince William Sound product may be relegated to low value uses such as cat food.) Analytically, this is a downward shift in the demand curve. It is likely that in subsequent years the idled boats and fishermen will be re-employed. This is taken into account by reducing the charge in future years for the opportunity cost of idled resources.

Any claim the Trustees present to Exxon will be closely examined. One concern I have is that the investigators in a rush to meet the deadline will use approximations that would not be needed if they took the time to make the estimates correctly. For example, the investigators may assume that fish are fish and not distinguish among different markets for and quality variations among fish. Not only might these shortcuts produce biased estimates of the loss, but the approximations may be so unacceptable so as to provide Exxon with the opportunity to render the estimates useless.

Continued from p. 2

A second concern that I have is that the work is spread out over three studies and this may create additional problems such as:

* duplication of effort;
* gaps in research as one investigator thinks another is responsible;
* difficulty in integrating because the studies use varying regional definitions or time-frames or otherwise lack common denominators (groupings of fish, segmentation of the industry); and
* unproductive effort as information is collected without a purpose in mind.

The description of the method and analyses mention that previous studies will be reviewed. What literature do they have in mind? By what standards are the investigators going to judge the literature? Who is going to integrate the studies? How are they going to insure that the studies will be compatible?

A third concern is the spill's effects on the quality of life in commercial fishing communities is not counted by surplus and idled resource measures. There are reports that communities have had their faith in the bounty of the environment shaken and their livelihood threatened. Mental health professionals report (e.g., J. Randal, Washington Post, 9/26/89) the spill has led to increases in alcoholism and violence. The trustee should be aware that the cost of community disintegration is not considered in these studies.

Com.	Topic	Issue	Sug.	Sort
119	4	2295	X	2

A fourth concern, again, is the deadline. Even if there were off-the-shelf, current models of the fishing industry that could be identified and used, the use of the models would have to await the completion of the injury determination studies (e.g., Fish/shellfish studies #1-5; Marine mammal studies #4 & #5; and others). Either these biological studies will be finished long before the deadline or the economic study will not be completed by the deadline.

Com.	Topic	Issue	Sug.	Sort
120	4	0201	X	2

B. Economic uses studies:
   5. Economic damages to recreation; and
   7. Study of loss of intrinsic values

These studies are likely to be the most important and expensive studies conducted. The recreation study proposes to use three methods to estimate the damage: travel-cost, contingent value, and unit day. The intrinsic value study will also use the contingent valuation method. The contingent valuation method may turn out to be the most appropriate method to estimate the value of the compensation for the damage. While the descriptions of these studies are more complete than the descriptions of the other studies, there are important topics that are not discussed. Finally, it is impossible to conduct either study by the deadline.

Com.	Topic	Issue	Sug.	Sort
121	3	2250	X	2

The travel cost method will be one of three methods used in the recreation study. It estimates demand curves (a relation between price and quantity) by using travel costs and an imputed value of time as proxies for price and recorded visits to the site (region) as a proxy for the quantity variable. This relation between price and quantity is estimated for the pre-spill and post-spill case. The difference in surplus between the two cases is estimated and used as a measure of damage. The problems the investigators face are: selecting sites (travel to Alaska may be a package and if part of the package is spoiled by the spill travel to other parts of Alaska may be forgone; in this way the effects of the spill spread to all parts of Alaska) and valuing time.

This oil spill is on-going; it is not an event. The travel-cost method uses pre-spill and post-spill data on recreation use, tourism (prices and quantities) and hunting and fishing licensees. But, post spill data cannot be collected until the spill is over. The spill is not over. Data collected for the spring and summer of 1989 is data representing recreation during the spill. This is important to know. But it is equally important to know participation in recreation in the future. There is no basis for an assumption that tourism will return to normal in 1990. Unless the investigators have a method for estimating participation in 1990 and subsequent years then the travel cost approach has a potentially serious flaw.

The unit day approach relies on expert opinion to estimate WTP. It should be used only if no other method can be used.

The third approach used in the recreation study is contingent valuation (CV). CV solicits the willingness-to-pay (WTP) for an Alaskan recreational experience. CV methods take some time to perform correctly and cannot be done correctly by the deadline.

last sec, comment on page 5

CV methods are also used in the intrinsic study. Individuals are asked about their WTP for pristine resources or their willingness-to-accept (WTA) compensation for the damage done to their natural resources. WTA estimates how much compensation is needed to restore the well-being of citizens to the pre-spill level. Society loses when an oil spill causes sorrow, outrage, and other feelings of despair. Individuals spend valuable resources to avoid feeling such emotions. The value of the compensation required to bear such feelings will only be captured in the intrinsic value study using contingent valuation methods.

Com.	Topic	Issue	Sug.	Sort
122	3	2270	X	2

Both a WTP and a WTA approach should be used in the CV studies. Under WTP, industry is assigned a quasi-property right to the resource because industry pays the government what the public would have been willing to pay to use the resource. Under WTA, the public is assigned a quasi-property right to the resource because industry pays to the government what the public would be willing to accept to let industry use the resource. For resources with close substitutes, WTP and WTA are approximately equal (See Willig, Am Econ Rev, p.589 1976 and Hausman, Am Econ Rev, p.662 1981), but for unique resources there may be large differences between WTP and WTA (Hanemann, Am Econ Rev, forthcoming). Since it is believed that it is easier to design WTP questions than it is to design WTA questions (Carson and Navarro, Nat Res Jour, p.815, 1988) and since if the resource has close substitutes the same approximate answer results, investigators tend to favor the WTP approach. The natural resources damaged in Alaska, however, may be unique and both WTP and WTA approaches should be used.

Contingent valuation consists of using surveys to identify and quantify economic values that are contingent upon an actual market existing. In particular, markets for recreating and, separately, intrinsic Alaskan natural resource values are simulated using surveys. The survey results are susceptible to bias and questions must be designed and pre-tested to avoid bias. Often focus groups are used in the design and pre-test process.

There are two survey designs: iterative bidding formats and non-iterative formats. In both designs the amenity being valued must be described sufficiently so that the respondent knows what he is being asked. This description may include photographs, sketches, written description, videos, verbal descriptions and the like. In the iterative format the respondent is asked a series of questions to identify the value. For example, the interviewer may show the respondent a picture of a dog and then asked if he is willing to pay nickel for the dog? a dime? a dollar? with the amount increasing until the respondent indicates the highest price he would be willing to pay for the dog. In the non-iterative format the respondent is asked to either answer yes or no to a single state value ("Would you pay 50 cents for this dog?) or is asked to write down the amount he would pay (Please state on the line indicated how much you would pay for the dog.) It is generally acknowledged that the iterative interview method is more reliable.

see comment on p. 6

In either format, the survey instrument will have, at least, two parts. The first to record bid information, the second to record demographic information.

Conducting a CV study requires several steps. First, the spill damage is assessed and described so that the respondent knows what he is paying to avoid or being compensated to accept. Second, questionnaires are developed and tested for biases such as anchoring and for misunderstandings. They may have to be revised. If the revisions to the questions are extensive, a second pretest may be needed. At this stage, a focus group might be given alternative descriptions of the spill to develop a robust description. The questions should have a wide scope. Individuals should be asked not only about their values for the loss of particular animals but also about how they value the loss of a pristine environment and unspoiled wilderness. Third, the population of eligible respondents is determined and sampled. For the Alaskan oil spill the eligible population to be sampled must

include all U.S. citizens and possibly residents of other countries. Fourth, the questionnaires are administered. This may take considerable time if the sample is large. The final steps are tabulation, aggregation, and interpretation of the results. It is plain that there simply isn't enough time to perform a contingent value study by the deadline.

Two other issues in assessing damage and making restoration plans are the speed of recovery and uncertainty. Some of the more important estimates the biologists and other physical scientists can provide are estimates of how long it will take the environmental and natural resources to recover from the spill. This information is important not only because it sets the period for claiming diminution of use values; but also, if the damage is irreversible, catastrophic, or has long lead times economists must consider a larger set of future uses. If, for example, the damage is estimated to last for 5 years, then the future uses of the resources may be considered as known (i.e., committed). If, on the other hand, the damage is estimated to last for 50 years, committed uses may impart little information about the future and more speculative uses must be considered in the analysis.

All of the estimates of damage are going to be subject to uncertainty -- uncertainty about magnitude and duration of the resources lost and damaged; uncertainty about how much compensation citizens need to restore them to a pre-spill level of well-being. This suggests that a single-point estimate of the damages should not be relied upon as the measure. Instead the results should be reported as distributions.

see comment on p. 6

C. Economic use studies:
4. Effect on value of public land;
6. Effect on subsistence households;
8. Effect on research programs; and
9. Effect on archaeological sites.

These are four studies of the impact on the spill on well-defined targets. Each has its own problems that are not addressed in the study descriptions.

* Public land. How are the investigators going to "project market demands for leases and sales in the area affected by the oil spill". This is the central analytical element. Are they going to use hedonic techniques? are they going to use the opinion of appraisers? both? It would seem that the results of economic study #3 "Bioeconomic models for damage assessment" would have to be completed prior to completing study #4 because there may be important effects on fishery resources that will be reflected in the value of public lands.

Com.	Topic	Issue	Sug.	Sort
123	3	2240	X	2

* Research programs. The tabulation may be able to be confined to a table listing project, amount, delay, and the funds put in jeopardy by the spill. The results will depend on the duration of the spill and its effects.

Com.	Topic	Issue	Sug.	Sort
124	3	2280	X	1

* Archaeological study. How are the investigators going to assess the economic damage to the site? will they use appraisers? CV methods? The description mentions a field survey. Unless it is already completed, then to perform the study by the deadline means doing a field study during the Alaskan winter.

Com.	Topic	Issue	Sug.	Sort
125	3	2290	X	2

* Subsistence study. This study looks well thought-out, but it cannot be completed by the deadline because the effects of the spill will still be occurring.

Com.	Topic	Issue	Sug.	Sort
126	3	2260	X	1

COMMENTS AND RESUME

OF

HOWARD LILJESTRAND, PhD

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24 October 1989

Bob Adler
Senior Attorney
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1350 New York Ave., N.W., Suite 300
Washington DC 2005

Dear Bob:

Com.	Topic	Issue	Sug.	Sub
127	3	1250	X	2

The proposed Air/Water Study Number 5 of the Exxon Valdez Natural Resource Damage Assessment Plan and Restoration Strategy on air pollution was sketchy, and the response to further questions provided only a few of the additional details needed to review the adequacy of the work plan. If this study had been proposed by an industry to a governmental agency for review, it would not be accepted in its current form. The proposal is still too vague.

The crucial questions are 1) which computer algorithms will be used, 2) what input data are available, and 3) what assumptions will be required to estimate the release of volatile organics from the slick and deposition flux of gaseous organics to the receptors. These determine the accuracy of the model predictions and are needed in order to perform error propagation and error analysis.

The specific computer algorithms for release, dispersion and deposition were not identified, only that they would be USEPA approved. The various dispersion models have different capabilities, and the specific model needs to be identified in order to evaluate its inherent limitations. In particular, most of the standard models do not properly incorporate dry deposition fluxes into the mass balance. That is, dispersion models with dry deposition added frequently do not conserve the mass of the pollutant. The commonly used short-term ISC regulatory model would not be adequate. A model that 1) uses the solutions of Rao for simultaneous dispersion and deposition, 2) includes corrections specific for dispersion in overwater boundary layers, and 3) includes corrections for dispersion in complex terrain is recommended.

The main inputs to the dispersion models are the meteorological data and the source fluxes. The meteorological inputs have not been identified, other than that the National Weather Service is the primary source and measurements were made on Coast Guard vessels. From these, the wind vector and climatological history will be reconstructed. While the data is available for the determination of the wind fields, it is not apparent that the data required to determine atmospheric dispersion characteristics exists, especially over the long trajectories between the source (the oil slick) and receptor (site of deposition and impact). The types and extent of supplemental data, beyond that normally monitored by the National Weather Service, from the source and receptor areas becomes important in order to miminize approximations and uncertainties. A careful evaluation of dispersion is needed for this case of intermediate range transport.

cc next p. Too

The VOC source flux will be modeled with specific modeling of the benzene, toluene, xylene, and ethylbenzene fluxes. These species are all of the same class, monocyclic aromatics. These volatile aromatics have been singled out for the hazard assessment, because these compounds should have had concentrations which could be detected analytically. In terms of hazard assessment, the reference is not the limit of detection, but the reference contaminant level which has a biological impact. It is recommended that the

list be expanded to other components of crude oil which have much lower reference contaminant levels than those of the monocyclic aromatics, and it is recommended that flux calculations for specific compounds be expanded to representative chemicals other classes. For example, while the ratio of the fluxes by evaporation to dissolution is about 6:1 for the monocyclic aromatics, it is about 20:1 for polycyclic aromatics.

The dry flux of organics to plants will be included, although the parameterization of the dry deposition velocities for the organic compounds has not been specified. This is an area of relatively large uncertainty. A careful evaluation of the range of possible of deposition velocities should be made.

The main approximation is how to couple the evaporative flux to the air pollutant concentrations. These approximations have not been identified. The simplest models assume either a constant, average flux (release rate) or a first-order removal and use Gaussian plume dispersion models. The most complex use heat balances and mass transfer coefficients which depend on the meteorology. The evaporative flux depends on the oil slick composition, either by Raoult's Law in the ideal case or with activity or fugacity corrections in the non-ideal case. A careful evaluation of the range of possible of evaporative fluxes should be made, and in general, the simple approximations should be avoided.

Finally, error propagation and error analysis should be performed on the cumulative model results.

Sincerely,

Howard M. Liljestrand
Associate Professor of Civil Engineering

COMMENTS AND RESUME

OF

D.K. BUTTON, PhD

Mr. Bob Adler
Natural Resources Defense Council
1350 New York Ave., N. W.
Washington, DC 20005

October 23, 1989

Dear Mr. Adler

Review of the damage assessment and restoration activities associated with the *Exxon Valdez* oil spill is from the perspective of the status of the investigation at this point, and what should be done from from here out. Opinions were formed mainly from activities and results seen to date along with conversations with officials and workers in a number of areas.

1. Much focus has been on those effects which are visible and on the high end on the food chain; oil slick movement, oily and discolored beaches, and affected birds and mammals.

2. The progress of weathering, i. e. evaporation, dissolution and effects microbial oxidation of the hydrocarbon distribution within the component of beached oil, and associated fertilizer effects, all of which relate to the quantity and quality of oil persisting, appears to be becomming well documented. Mechanistic aspects of the disolution process, particularly biodegradation, appears to be rather low-tech with extensive repetition favored over complete modern, and thoughtful measurements based on sound principals of physical cemistry. A better balance between field work and the laboratory and theoretical support seems desirable in order to locate changes in the less-obvious relationships. Perhaps we can describe which components disappeared, but cannot tell to what they were converted, where they went, or why. Less obvious actors and bioconversions the process of biodegradation does not mean less important. For example half the oceans biomass is bacterial, yet measurements used are sensitive to only a fraction of a percent of these organisms. Efforts to understand biodegradation of mixed hydrocarbons in the oil phase, a key removal process in this instance, has not been attempeted. In laboratory culture, 70% bioconversion of aromatics can be to hydroxylated aromatics, compounds which account for most of the biochemical activity, carcinogenicity for example, of the parent compound, yet production of these compounds by bacterial action in the beaches remains unmeasured.

Seventy three miles of beach were treated with 40 tons of fertilizer without understanding these basic mechanisms affected. Well-controled laboratory experiments with structured mixtures of hydrocarbons, key components of which are radio-labeled as tracers are in order.

3. Documentation of the passage of particulate hydrocarbons to benthic biota appears to be progressing well.

4. Significant efforts are underway to document changes in tissue chemistry and normal biochemical components in benthic fishes and offshore fishes related to the oil spill. While effects have also been measured on inshore fishes such as salmon, these investigations are more limited. Routes of contamination which involve dissolved hydrocarbons from the water column, as opposed to collection of particulate hydrocarbons by the benthos, are not understood.

Short-term laboratory studies of isotopic hydrocarbon uptake by fishes in bacteria-free systems could help decide if the hydrocarbons in salmon, for example, come from the dissolved phase through the gills, or from particulates first collected by their food organisms.

5. Induced changes in water chemistry appear to have been neglected even though the solubility and dissolution rates of light hydrocarbons and aromatics are known to be great. Sensitive measurements of the type required to document these changes were not implemented. It is too late to begin these now, but the technology should be in hand. Neither have measurements of metabolic products of the type documented in fishes (3 above) been attempted, yet their formation in the water column may be even more extensive. As alkylating agents, these are the bioactive components rather than the hydrocarbons as pointed out above.

Effects of the present spill as part of an accumulating load in marine systems due to the decade-to-century life times of hydrocarbons and their products appear not to be addressed. This is seen as a problem of scope, considering the spill as a regional problem when the impact is more its contribution to global changes in water chemistry. Since these changes are slow and cumulative, it is not to late to attend to the Alaskan contribution. The main question is how an increasing load of hydrocarbons and their products affects the functionality of the ocean.

Required studies involve systems sufficiently well controlled so that effective concentrations can be sustained without losing them to bacterial activity, and thus get results over reasonable time frames.

Com.	Topic	Issue	Sug.	Sort
128	3	0100	X	2

In summary, the most significant damage impact not well addressed, in my opinion, is contribution of the spill to global change. Potential impacts are quite real. And, as in the case of egg-shell thinning from the products of DDT metabolism, careful investigations can establish cause/effect relationships. A significant fraction of the world ocean circulates through Alaska, and we add components to it that will be present for centuries. The fact that other nations may not be good world citizens does not relieve us from the responsibility of containing our discharges; someone needs to lead. The damage impact assessment seems to say that if the offending components leave Prince William Sound, which indeed they do in a few days or weeks, then they are not in fact of concern.

D. K. Button

COMMENTS AND RESUMES

OF

STEVEN WRIGHT, PhD, KIM HAYES, PhD

AND TIMOTHY VOGEL, PhD

Comments on Natural Resources Damage Assessment Plan for the Exxon Valdez Oil Spill

Coastal Habitat Study Plan: In general the assessment plan seems to lack a study related to the fate and transport of oil in intertidal and supratidal zones. In the Coastal Habitat studies, a more comprehensive plan for assessing the physical/chemical interactions of the oil with the coastal sediments needs to be given. This might be done by adding two additional projects to the Air/Water study plan such as: (1) Evaluation of Petroleum Hydrocarbon persistence in Intertidal Sediments, and (2) Evaluation of Petroleum Hydrocarbon Persistence in the supratidal Sediments. In the current description of the coastal habitat studies, it appears these areas are not covered or that the research plan is not given in sufficient detail to indicate that they are to be studied.

Com.	Topic	Issue	Sug.	Sort
133	3	1100	X	2

Measurement of Petroleum Hydrocarbons. A more comprehensive plan needs to be developed and included in the report, indicating what oil components will be screened and how they will be measured analytically. The only information given in the report (p40) states that analyses to be done are TPH/GC and PNA/SIM characterization of marine sediments, TOC on selected samples and size fraction analysis on representative samples. It will be essential to perform a comprehensive analysis of the change in composition of the oil in the sediments in time by monitoring appropriate classes of hydrocarbon components of the oil. Total Petroleum Hydrocarbon (TPH) analyses will not be adequate to assess the damage or to monitor remediation efforts. It is recommended that individual components of the oil be monitored throughout the study at selected sites covering a wide range of molecular weight size classes. This will be essential for assessing the potential damage and be necessary if one is to effectively monitor temporal changes and to determine how well natural, as well as, engineered remediation efforts are working.

Com.	Topic	Issue	Sug.	Sort
134				

Coastal Habitat Study, p. 31 - Mention is made that studies will be performed on 3 degrees of oiling; none, light, and moderate to heavy. It would appear that the *light* classification may be insufficient to clearly delineate the extent of the problem. For example, a section of shoreline might have been lightly oiled within a few days of the spill or it may have been contaminated two months later. The composition of the residual oil will have significantly changed over this time frame and therefore the environmental response may well be significantly different. It seems as though a time aspect to the contact must be included as well; i.e. whether it is contacted soon after the spill or not.

Com.	Topic	Issue	Sug.	Sort
135	3	1110	X	2

Air/Water Study 1, p. 37 - Mention is made that "Oil spill models will be used . . .". Such models will probably not have sufficient accuracy or spatial resolution to provide any basis for estimates of spill extent or volumes. The oil spill models will be only as accurate as the estimates of general circulation within the system and it is not made clear how this information will be generated. Only field studies would provide the sort of information required such as detailed circulation pattern. These studies need to be performed.

Com.	Topic	Issue	Sug.	Sort
136	3	1210	X	2

Coastal Habitat Study, p. 32 - States that "four vertical transects will be established on each of the 150 sites . . .". The spatial resolution of these transects is not provided. This should be a critical issue particularly in the breaker zone. It may be visualized that in the area of active sediment transport (which is near the location of wave breaking), oil will be entrained into the sediment much more readily than elsewhere. Depending upon tidal fluctuations, this may or may not encompass a significant distance across the shoreline. No indication has been given that these physical processes have been considered and the description provided, as elsewhere in the report, is simply insufficient to know whether or not this issue will actually be resolved by the sampling procedure described. It does seem likely, however, that with 600 transects, the spatial resolution of the sampling will be limited. In order to have better *understanding* several sites need to be examined in greater detail.

Com.	Topic	Issue	Sug.	Sort
137	3	1110	X	2

Detailed studies regarding microbial diversity changes as a result of the oil spill is necessary. An ecology cannot be examined without studying the bottom of the food chain. Laboratory studies examining the influence of oil on microbial diversity combined with measured changes in microbial populations at the spill location will aid in determining impact. In addition, long term studies regarding the recovery of microbial populations in the spill area are needed.

Com.	Topic	Issue	Sug.	Sort
139	3	1260	X	2

Comments 140 to 142 are between comments 19 & 20.

Comment 143 is between 114 & 115

05

HOLLIDAY ENVIRONMENTAL SERVICES, INC.
ENVIRONMENTAL ENGINEERS & REGULATORY CONSULTANTS

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TOMBALL, TX 77375-1080
TELEPHONE 713-351-7591
TELECOPIER 713-255-3554

13 September 1989

Trustee Council
Box 20892
Juneau, Alaska 99702

Gentlemen:

RE: DAMAGE ASSESSMENT - EXXON VALDEZ

Pursuant to the Federal Register notice dated 15 August 1989 [54 Fed. Reg. 33618], we attach comments regarding the captioned report dated August 1989.

The comments, as submitted, are critical of the report. However, they are submitted in hopes of providing an industrial balance to the assessment plan. .

Very truly yours,

G.H. Holliday Ph.D., P.E., DEE
President

a8906-48

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COMMENTS ON STATE/FEDERAL NATIONAL RESOURCE DAMAGE ASSESSMENT PLAN FOR THE EXXON VALDEZ OIL SPILL - PUBLIC REVIEW DRAFT - AUGUST 1989

By

G.H. Holliday Ph.D., P.E., DEE

INTRODUCTION

There is no question the Clean Water Act [33 USC 1321(f)(5)] authorizes the State to "...act on behalf of the public as trustee of natural resources to recover...costs of replacing or restoring...resources [lost or damaged by oil ...discharged in violation of section(b)(3)...". Nevertheless, the proposed oil spill assessment appears premature. In effect, this instant assessment is the equivalent to assessing the results of an operation before the incision has healed. Additionally, the assessment report is biased toward an a priori establishing the oil spill occasioned harm to all natural resources. Also, the report is written to convey guilt by Exxon. The form of presentation of the various study follows a standard format saying "get Exxon". This is not normal writing form, since typically the topic of the report "Exxon Valdez" would be presented at the beginning of the report but not at virtually every page throughout the report.

Com.	Topic	Issue	Sug.	Sort
1	3	0100	X	2

Furthermore, lack of objectivity is demonstrated by allowing only government employees to participate in process. Participation of knowledge industry scientist provides balance and a broader viewpoint.

Com.	Topic	Issue	Sug.	Sort
2	3	0240	X	2

Comment: We find no restriction in the statute or regulations prohibiting participation by industry.

Specific Comments

1. Page 8, 3rd. bullet, line 2 - Slow response time

The report correctly states: "response equipment was not deployed quickly". However, the report neglects to state the real reason for the delay. First, the dedicated

For remainder of this comment letter ↙

Com.	Topic	Issue	Sug.	Sort
3	3	0109	X	2

To end

barge had been cleared of equipment for barge repairs. Second, Alyeska began loading spill containment equipment. The Coast Guard requested Alyeska remove the containment equipment and load oil lightering equipment. Then, the Coast Guard ordered Alyeska to unload the lightering equipment and then load spill containment equipment. The loading and unloading process approached a Chinese Fire Drill.

Comment The root cause was the indecision of the Coast Guard.

2. Page 8, 5th. bullet, line 1 - Insufficient equipment

The report states "[t]he number and size of booms available were insufficient to contain the spill". First, Alyeska had available all of the boom required by the Contingency Plan. Second, the Contingency Plan had been approved by the State of Alaska as adequate for tanker operations in Prince William Sound. Third, Coast Guard did not permit closing of the boom to encircle the tanker because of the danger of creating a natural gas bubble around the ship. Also, encircling the tanker would have interfered with lightering operations, i.e., ingress and egress of the lightering vessels.

Comment: Thus, placing blame on Exxon is not appropriate.

3. Page 8, 5th. bullet, line 2 - Too little equipment, too late

The report cites: "[f]ew skimmers were put to work during the first 24 hours". The Alyeska Contingency Plan includes a spill scenario almost identical with the spill associated with the Exxon Valdez grounding. The Plan clearly called for use of dispersants on an oil release of this magnitude. Experience shows removing of thousands or millions of gallons of crude oil from water is an impossible task using skimmers. When Alyeska requested agreement to apply dispersant in accordance with the preapproved plan, permission was delayed for days. A severe storm occurred immediately after government approval for use of dispersants. Accordingly, dispersant could not be applied in a timely fashion as prescribed by the State approved Contingency Plan.

Comment: Government interfered with proper oil spill remediation by not following the preapproved plan.

4. Page 8, 5th. bullet, line 3 - No oil recovery barge

The report criticizes Alyeska for not having a barge available to contain recovered oil. In fact, the state approved Contingency Plan did not contemplate skimming such

large volumes of oil. Also, the plan did not require an oil recovery barge, since the plan specifically relied upon dispersing the released oil.

Comment: The government is finding fault with the preapproved spill plan after the fact.

5. Page 8, 6th. bullet, line 9 - Not enough containment equipment

The report states: "there was not enough equipment [spill containment] equipment left to contain the oil or to protect other sensitive areas". The amount of spill containment equipment available at the site was exactly that specified in the State approved Contingency Plan. Most of the available boom was deployed at the grounded tanker. The use of dispersants would have freed booms for other uses and permitted better control and countermeasures.

Comment: It is easy and politically expedient to avoid recognizing a preapproved Contingency Plan existed.

6. Page 9, 6th. bullet, line 2 - Mousse and tar balls

The report discusses "mousse and tar balls". However, the authors neglect to discuss the fact the oil now contains less aromatics and there is much less toxic to fish and wildlife.

Comment: Mousse and tar balls are made to portray a very bad situation.

7. Page 11, Fate and effects of the spilled oil

This section contains many statements of speculation and equivocation. For example:

a. Page 11, last paragraph, line 1 - Intertidal speculation

The report states "[w]hen floating oil or mousse contacts land, it may be stranded in the intertidal zone". (emphasis added) With all of the expertise of the Interagency Shoreline Cleanup Committees [page 11, carryover paragraph, line 5] it appears an unequivocal statement could be made about whether the oil was or was not stranded in the intertidal zone. The entire last paragraph on page 11 contains statements designed to suggest great danger to the environment but without proof or citation of data or references.

Comment: Technical honesty appears to have been forgotten in the Fate and Effects discussion.

b. Page 13, paragraph 1 - Many marine oil spills have occurred

This paragraph discusses oil spills as if the Exxon Valdez was the first occurrence. During the Second World War many tankers and fuel carrying ships were sunk along the East and West Coasts of the United States. We think of these shorelines as pristine today. Yet those same shorelines were contacted by released oil. Additionally, oil seeps exist in many places along the West Coast, for example, Coal Oil Point, California near Santa Barbara. Accordingly, we know the fate and effects of crude oil releases.

Comment: We do not need to rely on speculation.

c. Page 13, last paragraph, line 1 - Cold temperature stability of Hydrocarbons.

The report states "[i]n general petroleum hydrocarbons are more stable in cold climates than in warmer ones". (emphasis added) No support for this statement is offered for the Prince William Sound. The severity of the storms and, in particular, the storm immediately following the oil release indicates a substantial lack of stability of hydrocarbons in the cold climate because of the violent wave action and the high wind speeds which promote evaporation.

Comment: The statement contained in the report appears designed to place the worst possible light on the conditions surrounding the spill.

d. Page 16, paragraph 1, line 7 - The trustee forgets the EIS.

The report at this point discusses exposure of archaeological sites, wilderness areas, National Forests and National Parks to oil spills. This is true. However, this fact was included in the Environmental Impact Statement which State and local government personnel reviewed and accepted. Additionally, Federal, State and public personnel knew the oil would leave Alaska via tankers from Valdez. It is politically expedient but naive to believe there would never be a tanker accident. The tanker accidents on French and American shores, plus the spill in the Strait of Magellan brought possible spills to minds of the public, Federal and State personnel. No one acted before the Exxon Valdez spill. However, many bureaucrats and "public interest groups" reacted violently after the Prince William Sound spill. None of the bureaucrats or "public interest groups" said anything good about the thousands of successful trips made into and out of the loading docks at Valdez.

Comment: The exposure was known, the State prospered financially as never before. In effect, the state accepted the risk for the income.

e. Page 18, paragraph 4, line 7 - The trustee appears reluctant to follow the regulations.

The trustees state they "have not decided whether or to what extent, to utilize [type B full-field assessments] ...regulations in conducting the assessment". In effect, the trustees do not feel obligated to follow the law [43 CFR Part II].

f. Page 20, paragraph 4, line 3 - The trustee proposes a major Federal Act without an EIS

The study contemplates determining "actual presence of petroleum residues...in tissues of resource organisms". In other words the proposed Natural Resource Damage Assessment Strategy will adversely impact the environment by killing marine organisms. Accordingly, this Federal action must be sanctioned under the National Environmental Protection Act [NEPA] by preparing an Environmental Impact Statement. The magnitude of the fish, animal, bird and organism kills proposed in the name of science can be recognized by reviewing the proposed studies. There are 64 studies proposed costing $35,420,900. The majority of the studies include robbing some critter of its life in the name of science. Such a large Federal undertaking must include an Environmental Impact Statement!

Comment: The magnitude of marine organisms kills mandates preparation of an EIS.

g. Page 24, paragraph 5, line 6 - Authors show bias

The bias of the authors of the report is stated clearly by saying "[t]he purpose of the studies are to establish that injury has occurred..." (emphasis added). There appears little consideration that injury has not occurred everywhere.

Comment: The conclusions to be drawn from the assessments are already "set in concrete".

8. Studies

a. Page 36, paragraph 1, line 4 - Air modelling is not accurate

The air studies contemplate use of air models. Air dispersion are known not to be accurate. In fact EPA uses air dispersion models to provide worst case results. The

use of know inaccurate models for the instant assessment makes a mockery of the Quality Assurance/Quality Control [Appendix A] praised so highly throughout the report.

Comment: In effect, relying on inaccurate models converts a scientific assessment into a revenue generating project.

b. Page 37, last paragraph, line 3 - Oil spill trajectory models are not accurate

The studies contemplate use of oil spill models. Experience teaches us oil spill models are inaccurate. We use them to guess where the oil will go. However, if a spill occurs, the only reliable method of finding the oil is to ride a helicopter over the spill and establish by observation where the oil goes. Winds and currents are used in developing the models. Winds and currents are not constant in direction, duration and speed. Accordingly, any steady state conditions assumed for modeling results is a grossly inaccurate output.

Comment: Use of models known not to be accurate deny the damage assessment technical validity.

c. Page 42, paragraph 2, line 1 - Alaska Water Quality Criteria is not technically defensible.

The report cites the State of Alaska water quality criteria of 10 ug/liter. Both the State and industry know this ridiculous low value was developed on the basis of assuming chronic health criteria is 1 hundredth of the acute value. The rule of thumb was superseded in 1980 by a rational method of establishing the water quality criteria. Alaska has been formally requested to adopt the new method and resulting criteria values.

Comment" The State has not acted even though they know the present water quality criteria of 10 ug/liter is wrong and by Alaska law should be discarded.

d. Page 46, paragraph 2, line 3 - Air modelling is not accurate.

The report contemplates the use of modelling volatile organic compounds. Modelling is known to be not accurate. The typical error is 250 percent on the high side.

Comment: Accordingly, the use of models to assess damages or penalties on the basis of results recognized to be in error transforms the instant assessment into a revenue generating exercise devoid of scientific justification.

e. Page 48, paragraph 1, line 1 - Trustees claim oil discharged into areas outside of Prince William Sound.

Again, the authors reveal a lack of accuracy in their reporting. The report implies the Exxon Valdez discharged "crude oil" into fisheries at Cordova, Homer, Seward, Valdez, Whittier, Kodiak, and Sandpoint. In reality, the oil was released into Prince William Sound.

Comment: The technical honesty of the instant report does not match the technical honesty implied by the authors.

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Curriculum Vitae

G.H. Holliday

Dr. Holliday holds four engineering degrees including a Ph.D. in Civil Engineering. He worked for Shell Oil Company for 37 years as a Engineer, Drilling Foreman, Production Foreman and Production Superintendent. The last 16 years with Shell were as an Environmental Engineer in E&P. Dr. Holliday retired from Shell in 1986 and formed Holliday Environmental Services, Inc., a full line Environmental Engineering Consulting firm working exclusively for industry.

In total Dr. Holliday has performed more than 500 environmental compliance reviews of E&P facilities, both onshore and offshore. In 1980-81 Dr. Holliday was Distinguished Lecturer on Environmental Conservation for Society of Petroleum Engineers. Also, he is an invited participate at the SPE Forum on Environmental Engineering. Further, he has presented papers or prepared comments at Environmental Conferences such as the Oklahoma University Environmental and Ground Water Institute, and Underground Injection Practices Council. For the last two years he has been on the faculty of the Executive Enterprises E&P Environmental Symposium.

Currently, Dr. Holliday is the Texas State Chairman of the American Academy of Environmental Engineers, a dedicated group of professional engineers. Also, he consults to the Independent Petroleum Producers Association on environmental and occupational safety and health agency issues.

15.2.1

06

KENAI PENINSULA BOROUGH
144 N. BINKLEY • SOLDOTNA, ALASKA 99669
PHONE (907) 262-4441

DON GILMAN
MAYOR

September 13, 1989

Trustee Council
P.O. Box 20792
Juneau, Alaska 99802

Dear Sirs,

The Kenai Peninsula Borough has reviewed the State/Federal Natural Resource Damage Assessment Plan for the Exxon Valdez Oil Spill, August 1989, Public Review Draft. Our comments are outlined below.

Comments Regarding the Introduction of the Assessment Plan

One year is not sufficient to fully assess the damage to natural resources since impacts to fish and other resources will not be evident for three or more years. For example, the plan states that the damage to Pacific herring in Prince William Sound will not be known for at least three years.

Com.	Topic	Issue	Sug.	Sort
1	4	0201		1

The responsible party's involvement in the assessment should be limited to providing financial assistance to the Trustee to assure the objectivity of the assessment.

Com.	Topic	Issue	Sug.	Sort
2	0	0207		1

The chronology of the spill (page 6 to 11) is oriented toward Prince William Sound which lessens the importance of events that occurred in the Gulf of Alaska and Cook Inlet. More emphasis should be placed on the events in the Gulf and Cook Inlet such as the closure of much of the fishing season.

Com.	Topic	Issue	Sug.	Sort
3	3	0100		1

Figure 4 should be updated in the final assessment plan to accurately represent the full extent of the movement of oil. Studies should include all areas impacted by the spill.

Com.	Topic	Issue	Sug.	Sort
4	3	0100		1

The transport and fate of the oil in Cook Inlet is not discussed. There are indications that debris from the spill will accumulate on the west side of Cook Inlet. This should be addressed.

Com.	Topic	Issue	Sug.	Sort
5	3	0100		1

The discussion of impacts to sea mammals and birds impacted in the Gulf of Alaska and Cook Inlet should be discussed in more detail.

Com.	Topic	Issue	Sug.	Sort
6	3	0100		1

Com.	Topic	Issue	Sug.	Sort
7	3	0100		1

Comments Regarding the Injury Determination/Quantification Studies

The areas encompassed by the three geographic regions established for the Coastal Habitat Injury Assessment, (PWS, Cook Inlet and the Kenai Peninsula, and Kodiak and the Alaska Peninsula), are unclear. It is uncertain which of these areas include the west side of Cook Inlet. A figure showing the regions would be helpful.

Com.	Topic	Issue	Sug.	Sort
8	3	0100		2

It is unclear if the Coastal Habitat Injury Assessment will include Upper Cook Inlet or the west side of Cook Inlet. Both of these areas were impacted by the Valdez Exxon oil spill and should be included in the assessment.

Com.	Topic	Issue	Sug.	Sort
9	3	1110		2

The Petroleum Hydrocarbon-Induced Injury to Subtidal Marine Sediment Resources Study (Air/Water Study Number 2) should include sites within Cook Inlet especially the west side of Cook Inlet.

Com.	Topic	Issue	Sug.	Sort
10	3	1220		1

Comments regarding the Fish/Shellfish Assessment are listed in the table below.

Study No.	Comments	Com.	Topic	Issue	Sug.	Sort
6	This study should include Upper and Lower Cook Inlet.	11	3	1360		1
7	This study should include Upper Cook Inlet	12	3	1370		1
8	The areas to be studied are unclear.	13	3	1380		1
9	Cook Inlet and the west side of Cook Inlet should be included in this study.	14	3	1390		1
12	Kamishak Bay and the lower Kenai Peninsula contain herring fisheries that may have been impacted by the oil spill. These areas should be included in the study.	15	3	1420		1
21	Clams are present in Kachemak Bay and the west side of Cook Inlet. These areas should be included in the study.	16	3	1510		1
23	This study should include the Kenai Peninsula and Cook Inlet.	17	3	1530		1

Generally, this assessment is oriented to Prince William Sound (PWS). Although the PWS was severally impacted, the Gulf of Alaska and Cook Inlet are equally important to the State of Alaska and were also impacted by the spill. These areas should be given equal attention during the assessment process.

Com.	Topic	Issue	Sug.	Sort
18	3	0100		2

This assessment plan was written prior to the full impact of the oil spill. The west side of Cook Inlet and Upper Cook Inlet are largely ignored by the assessment plan. The Trustees should re-evaluate the areas to be assessed by the proposed studies with consideration to the entire area affected by the oil spill.

The Kenai Peninsula Borough would like to be informed on the progress and results of all studies taking place within the Gulf of Alaska and Cook Inlet.

Com.	Topic	Issue	Sug.	Sort
19	6	0100		1

Sincerely,

KENAI PENINSULA BOROUGH

Alice Bullington

Alice Bullington
Environmental Technician

AB/nj

15.2.1

Alaska AquaFarms Inc.

P.O. Box 7
Moose Pass, Alaska 99631
(907) 288-3667

09

12 September, 1989

Dear Sirs:

Alaska Aquafarms Incorporated (AAI) operates an oyster farm at Fairmount Island, Prince William Sound. We have read Natural Resource Damage Assessment Plan for the Exxon Valdez Oil Spill August 1989 and offer the following comments and suggestions.

Research from the Amoco Cadiz spill offers a myriad of information on the effects of oil on oysters. It is clear that the affects are highly variable depending on the type of oil, concentrations and lifestage of the animals. It would benefit AAI if a study could be done in vitro to determine the effects of various concentrations of Prudoe Bay oil on juvenile oysters (20mm to 60mm).

Com.	Topic	Issue	Sug.	Sort
1	4	1570		1

We were successful in containing our operation with booms after the spill and our exposure to oil, to our knowledge has been minimal. The claim we have with Exxon is the loss of growth and mortality associated with keeping the animals behind a boom with essentialy little or no flow. It is unclear at this point how Exxon perceives this claim. Regardless, we would like to add a test to the project proposed in the Assessment plan (Fish and Shellfish Study Number 16) to attempt to mimic the conditions the oysters were under this spring. Fortunately we have 2 years of monthly growth measurements to use as a baseline. The Alaska Department of Fish and Game assures us it could accomodate this parameter in the study.

Com.	Topic	Issue	Sug.	Sort
2	3	1460		1

It is unfortunate that this study was not carried out this summer. Implementing the study in the fall is worthy but belated. It is equally dissapointing that the MAC group out of Cordova did not follow the sampling routine as promised this spring. We can never recover the loss of these tests.

It is important to note that mariculture and other similiar activities are likely to increase in this region and shellfish such as oysters are ideal sentinnel organisms. Secondary contamination from fishing vessels and ballast are a growing concern. Studies concentrating on low level chronic exposure and their effects on shellfish would be valuable.

AAI is appreciative that this study will be funded. We will be more than willing to assist in whatever capacity necessary to insure the project is successful.

Sincerely,

James "Jeff" Hetrick
President

15.2.1

07

Prince William Sound Aquaculture Corporation

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A regional non-profit organization for the enhancement of salmon.

September 12, 1989

Trustee Council
P.O. Box 20792
Juneau, AK 99802

Dear Sirs:

The Damage Assessment Plan for the Exxon Valdez Oil Spill arrived at our office on August 25, 1989. I am supposing that most of the field work included in the Plan has been completed. Therefore, I am uncertain as to the value of my comments.

For the record;

1. Coastal Habitat Study Number 1: The oiling and persistence of oil on shorelines adjacent to pink and chum salmon known rearing locations should be considered as a factor which might drive fish away from those traditional areas. The result might be reduced early ocean survival.

Com.	Topic	Issue	Sug.	Sort
1	3	1110		2

2. Fish/Shellfish Study Number 3: Will the tag/recovery project be allowed to continue long enough to assess relative survivals of pink, chum, and coho salmon released from hatcheries in 1988, 1989, and 1990? This must be done.

Com.	Topic	Issue	Sug.	Sort
2	4	1330		2

3. Fish/Shellfish Study Number 4: This study should go farther than comparing presence and condition of rearing salmon in oiled and non-oiled areas. Based on available information, the early marine rearing locations of pink salmon fry at the Armin F. Koernig Hatchery is known. The description of these areas should enable researchers to find similar locations at other hatcheries and major spawning streams. The presence/absence of young salmon in these locations might help determine if young salmon have been forced out of traditional rearing areas in oiled locations.

   This study could also improve the description of preferred rearing conditions, for future forecasting studies.

Com.	Topic	Issue	Sug.	Sort
3	3	1340		2

Alternatives for restoration of lost use should not be confined to locations now producing fish. If restoration is in order, consideration should be given to the diversification of hatchery production to include early run stocks for release at as yet undetermined locations.

Com.	Topic	Issue	Sug.	Sort
4	4	0102		2

4. I believe that current and tide flow studies should have been included in this impact assessment plan. This information is available for coastal British Columbia, but yet the state and federal government choose to ignore the potential of this information in the well traveled, inside coastal waters of Alaska. Current and tidal direction and transport around and between islands and passages are needed to properly assess the actual distribution of oil from the Exxon Valdez spill, which in turn would provide a greater understanding of the actual volume of water which was subject to pollution. These data would also aid in the response to future spills.

Com.	Topic	Issue	Sug.	Sort
5	2	0103		2

5. In 1977, Ralph Pirtle published an Alaska Department of Fish and Game, Technical Data Report (number 35) titled "Historical Pink and Chum Salmon Estimated Spawning Escapements from Prince William Sound, 1960-1975." In that report, Ralph states that there are about 680 streams in Prince William Sound, and most are used to some extent by spawning salmon. The same report includes a sequential list of 871 designated salmon streams for Prince William Sound. He also stated that aerial surveys were conducted on only 200 of these streams annually, and 94 index streams were ground surveyed each year. Something seems wrong to me with interpreting and using data which is derived from a percentage of a percentage.

Fish/Shellfish Study Number 1 proposes to document the physical extent of oil distribution on intertidal spawning areas and to achieve four other objectives dealing with injury to salmon spawning areas, and therefore salmon, in Prince William Sound. The study proposes to do this by surveying "a statistically significant number of (tentatively 100)" of the 211 aerially surveyed index streams in the Sound.

Com.	Topic	Issue	Sug.	Sort
6	3	1310		2

Comment: It seems to me that this Study avoids the opportunity to improve the baseline information on the productivity of Prince William Sound salmon streams, along with lost opportunity to develop a stream catalog of this information. In my estimation, this oversight results in the continued underestimation of the value of Prince William Sound's salmon resource.

6. Economic studies: I question whether these studies will be conducted, since no lead agencies or budgets have been designated.

Com.	Topic	Issue	Sug.	Sort
7	4	2200		2

Why is the damage assessment restricted to natural resources? Family disruptions, shortages of food and supplies, increased business uncertainties, and unavailability of housing are but a few of the variables that should be factored into damage assessment calculations for the Prince William Sound area.

7. General Comments: By what method will the Trustee Council and Management Team periodically review each project to ensure that it is proceeding toward successful completion?

Com.	Topic	Issue	Sug.	Sort
8	3	0100		1

May I obtain a list of the principle people, by agency, who are working on each Prince William Sound fish study? I believe it is likely that some project leaders are assigned too much responsibility, to the extent where individual projects and staff/public interactions may be negatively impacted or unnecessarily restricted.

Com.	Topic	Issue	Sug.	Sort
9	6	0100		1

When will study results be released to the public? Will I be able to review and comment on the study results before reports are finalized?

Thank you for considering these comments.

Sincerely,

John McMullen
Special Projects Manager

SELDOVIA NATIVE ASSOCIATION, INC.
P.O. DRAWER L
SELDOVIA, ALASKA 99663
(907) 234-7625 • 234-7890

40

September 5, 1989

Mr. John Turner: Director
US F&WS: Office of Management
Authority & Susan Laurence
P.O. Box 3507
Arlington, VA 22203-3507

FAX: (703)358-2232
Re: Permit file #P.R.T. 740502

Dear Sirs:

Com.	Topic	T	Sug.	Sort
1	2	1660	X	1

This letter is to state the Seldovia Native Association's strong disapproval and objection of the plans by the United States Fish and Wildlife Service(US F&WS) to capture wild sea otters in the name of science.

It is our understanding the US F&WS plans to capture 650 wild sea otters, then pull their teeth, draw their blood and put radios in their bodies.

This plan is totally unnecessary and does nothing for the sea otters. It smells of an attempt to disturb our wildlife in an effort to get more EXXON dollars.

Sea otters are extremely sensitive and subject to shock and even death when harassed. Any capture efforts by the US F&WS will only result in unnecessary torture and possibly deaths of the sea otters that survived the EXXON Valdez Oil Spill.

After all the hard work and dedication the volunteers gave to save sea otters after the oil spill, the US F&WS should recognize how fragile these mammals are.

We strongly object to this plan.

Com.	Topic	T	Sug.	Sort
2	6	1660		2

Further: we request public hearings in the affected areas, such as Seldovia, Port Graham and English Bay.

The US F&WS has already treated the otters at the little Jakalof Bay site. That should be enough cruelty to these mammals in the name of science.

Sincerely,
SELDOVIA NATIVE ASSOCIATION, INC.

Fred H. Elvsaas

Fred H. Elvsaas
President

cc: Senator Stevens
Senator Murkowski
Representative Young

Sandra Thomas, M.D.
P.O. Box 2724,
Homer, AK. 99603

9-5-89

John Turner
Director of USFWS
Office of Management Authority
P.O. Box 3507
Arlington, VA 22203-3507

Dear Mr. Turner:

I urge you to conduct public hearings regarding Alaska Fish and Wildlife Research Center's Application for Scientific Research on Sea Otters, file No. PRT-740502.

The Sea Otter has a history of being THE MOST political sea mammal, the protection of which has created heated controversy among the commercial shellfish industry, environmental groups, wildlife managers, and animal protection groups. Because of the controversial nature of public response to sea otters, it behooves you, as director of a federal agency representing and serving the public, to invite public discussion of any experimentation on sea otters and especially this latest proposal by Tony DeGange.

Mr. DeGange's application is questionable on many levels. First, the sample size is about equivalent to the total number of dead otters retrieved from the world's largest oil spill. This number is excessive! Second, the application minimizes the side effects of the operation, of the drugs administered, and of capture/handling trauma to wild sea otters. It was well documented in the otter recovery centers in Valdez, Seward, and Homer, that otters developed hematomas and infections post-operatively, developed allergies to drugs with the worst side effect being death, and developed intestinal ulcers, depression, anorexia also leading to death as a result of capture/handling trauma.

Third, the application is filled with vague statements. For instance, #7b1 states "when possible, individuals will be recaptured in order to evaluate the effects of marking". Yet, Mr. DeGange never addressed what effects,

even potential effects, of marking that he's looking for, nor does he state the frequency of recapture. Fourth, this application may violate the Marine Mammal Protection Act of 1972 by not providing bonifide scientific research and by duplicating existent or concurrent research.

Fifth, side effects of the operation including intrabdominal adhesions, subsequent inerference with future pregnancy in females and potential growth retardation in pups has not been addressed in the application.

Not only do I request public hearings because of all the above reasons, but also, I request that they be held in all of the Alaskan villages, towns, and cities affected by the Exxon Valdez oil spill.

Thank you for your attention to my request.

Sincerely,

Sandra Thomas, M.D.

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KBCS

KACHEMAK BAY CONSERVATION SOCIETY

BOX 956
HOMER, ALASKA
99603

September 3, 1989

Director U.S. Fish and Wildlife Service
Office of Management Authority
P.O. Box 3507
Arlington, VA 22203-3507

Dear Sir:

Com.	Topic	Issue	Sug.	Sort
1	3	1660	X	2

Our organization has serious reservations about some aspects of the USFWS application to capture numerous sea otters in the Prince William Sound area for long-term research. Although we support continuing research on the effects of the Exxon Valdez oil spill on sea otters, we believe that capture of as many as 650 otters, including tooth extractions, implantation of transponder chips, and other procedures, is more than is needed to accomplish the stated objectives of the study. This total number of animals sought and the implantation of radio transmitters in 275 otters appears especially excessive in view of the extenive disturbance and mortality sea otters already have suffered in Prince William Sound from the spill. Moreover, we understand that more than 100 otters have already been equipped with transmitters after release from rehabilitation centers. The research plan also recommends the repeated capture and handling of what seems like an inordinate number of pups and females.

Parts of sections 7 (page 12 and 13) of the application are inadequate. We understand that there have been some adverse effects to otters because of the stress of capture and handling. How many otters have succumbed from complications related to surgical procedures? Section 7 b? does not address at what level of adverse impacts procedures will be curtailed or significantly modified. How many losses of otters due to capture, handling, surgery, drugs, infections, or other causes will be tolerated before suspending or reevaluating the project? Item 3 on page 13 totally circumvents the issue of "harassment" to local otter populations. It is difficult to imagine no harassment involved with the pursuit and capture of 650 otters.

In sum we believe that the current application, which appears hastily written, should not be granted without modification and additional public input. Nothing in this application outlines what less intrusive research methods, such as behavioral observations and sustained censusing, will occur. Again, long-term research on sea otters is desirable, but we dispute the need for handling so many animals without considerably more justification than is provided. We request a public hearing so that the FWS can conclusively demonstrate its research needs and methods of achieving them, and the public should have an opportunity to voice its concerns for this species of special interest.

Sincerely,

Nina Faust

Nina Faust
President

15.2.1

21

FAX

P O Box 658
Homer, Alaska 99603
Sept. 2, 1989

Director, US Fish & Wildlife
Office of Management Authority
PO Box 3507
Arlington, Virginia 22203-3507

Dear Sir,

Having just this date received a copy of Alaska Fish & Wildlife Research's Permit Application [as appearing in the Federal Register dated (Aug. 8, 1989)], said Application requesting Permit to capture, drug, tag, bleed for sample, extract molars, take biopsy of visceral fat, insert transponder chip or radio transmitter, and monitor year-around up to 650 wild sea otters, I request a public hearing to be held immediately to scrutinize your reasons and methods for further invasive research of this natural

---

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Christine King Po Box 580 Homer, Alaska 99603
SANDRA THOMAS P.O. Box 2724, Homer, AK. 99603 P.T.C
[illegible] FRITZ CREEK 99603 235-[illegible]

ETITION CONTINUATION OF SEA OTTER RESEARCH PROPOSAL TO STOP THE DAMAGE ASSESSMENT STUDY #6 on MARINE MAMMALS

Saskia Achilles Box 3000 Homer, Alaska 99603 [signature]
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15.2 /

Comments on Specific Bird Studies Proposed in the August 1989 Public Review Draft of the "State/Federal Natural Resource Damage Assessment Plan for the Exxon Valdez Oil Spill"

Prepared by Staff of the National Audubon Society
Science and Sanctuaries Division

September 1989

GENERAL COMMENTS ON BIRD STUDIES

1. Our over-riding concern for the bird injury assessment is the lack of focus on synthesis and overall assessment. The plan states (p144) that the bird studies "will focus on species that best represent larger bird groups with similar life cycles..." and that " data on injury to indicator species will be related by inference to the larger groups they represent." This requires careful choice of indicator species and a well-developed plan for extrapolating measured damage to total impact. The Draft Plan as currently devised includes several poor choices of indicator species, lacks other important ones, and gives no description whatsoever as to how the results will be integrated. The most likely result, given its current state, is that the Draft Plan will result in a hodge-podge of single species studies with no hope of any synthesis or extrapolation even to species closely related to those chosen as indicators. It may be that the investigators have concrete and detailed methodologies developed to meet these goals; the Draft Plan gives no hint of them.

2. The desired outcome for the indicator species work undertaken should be estimations (most likely and worst case) for each species of (i) the number of individuals that were exposed to oil, (ii) the extent of exposure, (iii) the likely impact on survivorship and reproduction of exposure, and (iv) the population consequences of those impacts, including (iv.1) immediate as well as predicted (iv.2) for at least 10 (or preferably, the generation time for each species) years into the future. This set of

predictions for each indicator species would then have to be extrapolated to other members of the group represented by a given indicator and then the impacts would have to be summed across groups. This work will not be very precise and it will be dependent upon extensive computer simulations that match bird distributions, behavioral and ecological characteristics, and life histories with oil spill trajectories. We see no evidence in the Draft Plan that the studies are leading to integrated results of this nature.

3. A completion date of 28 February 1990 is unacceptable. While most direct mortality due to oiling should have taken place already, the population effects of oiling may take several years to unfold. These may be positive, negative, or neutral, depending upon the response of individual birds to oiling (Did they die, simply abandon the area for a year, or leave permanently?. Are breeding colonies in Prince William Sound net contributors to the Gulf of Alaska population of birds or are they sinks? If the former then the spill's impact will be vastly greater than what is now understood. If the latter it may be significantly less. Do pairs of seabirds breeding in Prince William Sound respond to oiling like seabirds studied in Hawaii, where oiling of eggs resulted in lower productivity for at least two years?). These various questions are representative of many that must be asked to gain a realistic estimate of the damage caused by the spill. None of them can be completed within a single season.

Unless studies involving breeding birds have been conducted this summer (1989) all of the studies except No. 14 will be seriously impaired. This requires at a minimum that the schedule be moved back a year, to conduct the proposed studies during the 1990 breeding season (May-August). With respect to restoration, one primary lesson from our restoration programs on the Maine coast is that the planning horizon is a decade, not a year. This is not due to a misplaced fascination for "long-term research." It is a simple recognition that the population effects must be dealt with on a time scale consistent with the generation time of the organism under consideration.

4. Each study has as its last objective "Identify potential alternative methods and strategies for restoration of lost use, populations, or habitat where injury is identified." None of the proposals however, provide any information on how this goal is to be met, nor do the study designs appear to be directed toward restoration strategies for populations or for damaged habitats (instead they are directed exclusively toward damage assessment).

5. The detailed studies on foraging behavior should not interfere with broad-scale population assessments. Only if real evidence should be presented that there are continuing problems with the spilled oil in known foraging areas would a detailed feeding study be warranted.

6. The language used in describing objectives throughout the bird study section is vague and unclear. In several studies the proposed methods are inadequately detailed to evaluate. For example, in Bird Study 1 it is stated, "A systematic survey using general methods described in the literature will be used." This is not specific enough to allow useful comments to be made.

7. In many cases the specific sampling methods are not identified, and it is therefore not possible to review whether the intensity of the sampling is adequate. The geographic scale of the sampling in general seems appropriate; most studies cover a range of areas. Middleton Island should act as a control colony for some of the studies.

8. We cannot evaluate the adequacy of the personnel to do the studies because they are not named nor are their experience and qualifications described. Furthermore, if and where contractors are to be used, there is no mention of who they will be, nor the extent of their participation. For these reasons also, it is not possible to evaluate the contract budgets.

9. The budgets are not reasonable as presented. In particular, equipment budgets seem outrageous, and travel budgets seem too small. It may be that aircraft and boat charter and operating expenses are included under "equipment" but this is not intuitive. If travel to and from study sites is included in the travel budgets, then the amount of field work to be done may be inadequate. In the budget throughout, it is also difficult to determine how much money is to be used for chemical analyses.

10. The success of the synthesis of effort depends on the GIS system working on schedule. Is it currently on schedule?

11. Overall, the proposed studies can document possible poor reproduction in the aftermath of the spill. Discovery of reduced breeding population size in affected areas, and a correlation between contamination and poor reproduction will point to the spill as the causative agent. Care should be taken, however, that not all "problems" are automatically blamed on the spill. Some reproductive failures, for instance, may result from other causes.

12. Where possible, we recommend that researchers collect random non-pathological samples of a small number of whole birds (both adults and chicks) for necropsy, and random pathological and non-pathological samples of feathers and blood (pathological samples of the latter will only be possible for moribund birds) for contaminant analysis. This will allow determination of the mean level of contamination of the population in relation to demonstrated pathological levels of contamination, and estimation of the lethal threshold of toxicity.

Review of the individual studies follow. The authors that have contributed to each review are specified.

Bird Study 1. -- Beached Bird Survey to Assess Injury to Waterbirds from the Exxon Valdez Oil Spill

Comments contributed by Dr. Wayne Hoffman, Biologist, Department of Field Research and Dr. Carl Safina, National Raptor Coordinator and Principal Investigator, Department of Field Research

It is unclear to us how Objectives A and B differ. In addition, mortality is not defined; is it used here to mean total numbers or the fraction of the population. The language in Objective F is likewise unclear; what is "lost use?" and how does that differ from "habitat"?

The methods are too telegraphic to be evaluated. We need to know what "Appropriate numbers" of beaches are. The flotation time, longevity, and drift experiments can be valuable contributions, but again they are difficult to evaluate without information on carcass condition, species chosen, tracking methods, sample sizes, and locations of beaches. Care needs to be exercised in interpretation of the drift experiments because confidence limits in the proportion of birds reaching the beaches will be large and may vary seasonally.

Bird Study 2. Surveys to Determine Distribution and Abundance of Migratory Birds in Prince William Sound and the Northern Gulf of Alaska

Comments contributed by Dr. Wayne Hoffman, Biologist, Department of Field Research

Once again, the methods are too briefly presented. What are aerial survey parameters (altitude, speed, strip widths, etc.)? What size "plots" are intended? Assuming that sampling intensity and statistical designs are adequate to factor out the normal seasonal and geographic variability in bird

numbers, this study will probably provide some of the best information on mortality in the whole package.

Bird Study 3. – Population Surveys of Seabird Nesting Colonies in Prince William Sound, the Outside Coast of the Kenai Peninsula, the Barren Islands, and Other Nearby Colonies Likely to be Impacted

Comments contributed by Dr. Wayne Hoffman, Biologist, Department of Field Research
and Dr. Stephen Kress, Principal Investigator, Department of Field Research

Assuming plot sizes are adequate and locations are appropriate, the methods for this study seem fairly straight-forward. However, more specific details concerning census methodology would prove useful. Natural population changes may mask any effect of the spill, unless the spill has a massive effect on many colonies.

We suggest that Middleton Island should be included as one of the controls. In general though we feel that "non-oiled" colonies are not a good control as these could also be suffering various effects from the spill.

Given the timing of the spill, it will be necessary to be very careful in comparing numbers at affected colonies to numbers at colonies not visited by the oil, because birds from "non-oiled" colonies could have been exposed to and affected by oil on their staging or winter habitats.

We do not agree with the choice of species here, and feel that the criteria for selecting "certain species" should be detailed. Burrowing alcids should also be included - Tufted Puffins, and perhaps Horned Puffins, as well as one or two auklets. Burrow occupancy rates might be a good measure of population changes.

Bird Study 4. Assessing the Injury of the Exxon Valdez Oil Spill to Bald Eagles

Comments contributed by Peter Bloom, Biologist, Department of Field Research
and Dr. Carl Safina, National Raptor Coordinator and Principal Investigator, Department of Field Research

Objective 'A' appears to be actually two separate objectives. It is also unclear in the methods whether just two surveys or weekly surveys are planned. We suggest that more than one remote nesting site be used in comparing this data with data from previous years (page 153, lines 3-4.)

Our suggestion for this study is that chlorinated hydrocarbons be looked at as closely as the hydrocarbons produced from the oil spill. If reproductive failures do occur we want to know which contaminants are responsible. If we don't have CH levels we may be left wondering whether the oil related hydrocarbons were really the principal culprits in declines of eagle populations.

This study involves feather, blood, dead bird, and addled egg samples. It would be useful to know how many blood samples of eagles will be analyzed. We suggest that a small (20) sample of fat be taken from adults of this species since blood reflects only the contaminants (CHs) consumed within the last few days (meals). Fat reflects the contaminants that have been stored over months or years.

An aspect of the Bald Eagle study which we strongly support is the determination of toxic effects of oil on eagles. Although it is likely that a few crippled eagles will need to be sacrificed for this study, we think it is worth it.

Bird Study 5. Impact Assessment of the Exxon Valdez Oil Spill on Peale's Peregrine Falcons

Comments contributed by Peter Bloom, Biologist, Department of Field Research

As with the Bald Eagle study, we likewise suggest for the Peregrine Falcon study that chlorinated hydrocarbons be looked at as closely as the hydrocarbons produced from the oil spill. Again, if reproductive failures do occur we want to know which contaminants are responsible. If we don't have CH levels we may be left wondering whether the oil related hydrocarbons were really the principal culprits in declines of bird populations.

This study also involves feather, blood, dead bird, and addled egg samples. We again suggest that a small (20) sample of fat be taken from adults of this species since blood reflects only the contaminants (CHs) consumed within the last few days (meals) whereas, fat reflects the contaminants that have been stored over months or years.

Bird Study 6. Assessment of the Abundance of Marbled Murrelets at Sites Along the Kenai Peninsula and Prince William Sound

Comments contributed by Dr. Wayne Hoffman, Biologist, Department of Field Research
and Dr. Stephen Kress, Principal Investigator, Department of Field Research

This study does not specify what analyses will be done on the collected adults. Furthermore, the number of observation periods (5), seems too small to accurately sample breeding activity.

Control sites for this assessment should be very distant from oiled sites, to minimize chances that the control population is not also suffering some effects. Even control birds may pick up oil at sea during migration or on the wintering range. We are especially concerned here about the validity of the "non-oiled" site within Prince William Sound as a control. Birds breeding in that area might well have dispersed to other parts of the Sound, especially in winter, and might have been affected as well. An additional control, perhaps in the Kodiak area would be valuable.

We also suggest that an attempt be made to assess numbers of Kittletz's Murrelets.

Bird Study 7. Assessment of the Effects of Petroleum Hydrocarbons on Reproductive Success of the Fork-Tailed Storm Petrel

Comments contributed by Dr. Fred Schaffner, Biologist, Department of Field Research and Dr. Stephen Kress, Principal Investigator, Department of Field Research

The statement "This species generally represents the shearwaters and fulmars," is a gross over-simplification. Petrels are neither shearwaters, nor are they fulmars. Although many Procellariiformes (other than diving petrels) feed on surface prey, some of which is considered "plankton", specific prey types and prey species vary and the distributions and habits, including diurnal vertical migrations, of the prey vary as well. This means that prey species may vary in their risk of exposure to oiling. Fork-tailed Storm Petrels appear to be an excellent subject for this study (because of the years of baseline data on distribution and population size, and because of the work already conducted concerning the impact of oil on these "easy to get at" seabirds.) Nevertheless, without studying other Procellariiformes in the area, we urge caution in extrapolating these results to many other species not studied. The shearwaters with which we are concerned (Sooty and Short-tailed) are largely divers.

Objective B states "Assess the impact of crude-oil exposure on storm petrel reproduction by measuring the relationship between exposure and breeding adult foraging efficiency, chick physiological condition, and nesting success." 1) The term "exposure" is not adequately defined. Methods indicate that they will actually measure the amount of petroleum hydrocarbons in the proventricular fluids ("stomach oil"), an extremely indirect measure of the amount of North Slope Crude to which the adult birds were exposed, although it is a less indirect measure of the chicks' exposure. 2) "Breeding adult foraging efficiency" - the draft has made a very poor choice of terminology, and they have made no attempt to define this term. Foraging occurs at sea, and can never be studied directly at a breeding colony. No methodology is presented to study foraging. Does the draft really mean to study the adequacy of parents' provisioning of their young with food? However, the draft presents no methodology to address this question either.

Foraging: An overall foraging rate can be measured as either (1) the amount of prey collected per unit time, or (2) the amount of food energy collected per unit time. Foraging efficiency can be measured as (1) the energy acquired by collecting food / the energy expended in collecting the food, and capture efficiency can be measured as the proportion of successful prey capture attempts.

Provisioning: An overall provisioning rate can be measured as the amount of food (energy, biomass, items) delivered to chicks by their parents per unit time. The chick provisioning performance of breeding adults can be affected by numerous factors, including:

(a) Food availability to foraging adults.
(b) Adult foraging efficiency. This could be reduced if adults are weakened by ingestion of petroleum (perhaps inducing anemia?).
(c) Distance prey must be transported to the colony. If parents must now transport food over distances much greater than the usual, they will require more food themselves, and will on average deliver food to chicks at longer, less frequent intervals.
(d) Transport ability of parents. If adults are weakened by petroleum ingestion they may have to reduce the size of the food payload brought back to chicks.

At the breeding colony, the draft proposes to measure:

1) The amount of petroleum hydrocarbons in the proventricular fluid of chicks and occasionally adults, and oiling on plumage.
2) Oiling of eggs by incubating adults, and hatching success.
3) Survival of chicks.
4) Incidence of petroleum hydrocarbons in pathological samples of eggs and birds, and fresh eggs.

Clearly, the proposed methodology is inadequate to address any of the elements of Objective B other than nesting success. Chick physiology is not addressed. Crude-oil exposure is not addressed directly. Foraging is not addressed. Provisioning is not addressed.

Suggestions: All birds examined should be weighed and bill, tarsus, and wing chord measured in order to document overall physical condition of chicks and adults, and whether there is any abnormality in development of chicks. Conduct more detailed field work to measure provisioning, including continuous watches of several nests and periodic weighings of chicks during the feeding hours for several consecutive days, in order to determine the feeding intervals and payload sizes. Underweight chicks might be getting as much food as ever, and low body mass might be due to toxic effects of petroleum ingestion.

Bird Study 8. Assessment of Injuries to Waterbirds from the Exxon Valdez Oil Spill on the Reproductive Success of Black-legged Kittiwakes in Prince William Sound

Comments contributed by Dr. Fred Schaffner, Biologist, Department of Field Research
and Dr. Stephen Kress, Principal Investigator, Department of Field Research

This proposal is modest, and realistic in its objectives to document possible poor reproduction in the aftermath of the spill. Discovery of reduced breeding population size in affected areas, and a correlation between contamination and poor reproduction will point to the spill as the causative agent. Caution should be taken however, to consider the potential role of other factors that might have contributed to poor reproduction in that breeding year. Control colonies should be remote, but not so distant that local factors could further confound a comparison with the oiled colonies.

This is a good choice of species for population monitoring because of the extensive baseline data and accessibility of chicks. It is important though that sample sizes be indicated in the methods section. The replicate counts are very important and should be an integral part of the study.

Suggestions: As with Bird Study 7, all birds examined should be weighed, and bill, tarsus, and wing chord measured in order to document overall physical condition of chicks and adults, and whether there is any abnormality in development of the chicks.

Bird Study 9. Assessment of Injury to Waterbirds Based on the Population and Breeding Success of Pigeon Guillemots in Prince William Sound

Comments contributed by Dr. Fred Schaffner, Biologist, Department of Field Research
and Dr. Stephen Kress, Principal Investigator, Department of Field Research

This proposal has many of the same shortcomings as Bird Study 7. It proposes to assess habitat use and food availability, but provides no methodology to do this. Food availability in foraging areas,

and foraging habitat use can not be studied directly at a breeding colony. For chicks, however, food availability is exactly their parents' provisioning performance. Unfortunately, the study methodology described is inadequate to assess adults' provisioning of chicks.

For this species, the chick provisioning performance of breeding adults can be affected by numerous factors including:

(a) Food availability to foraging adults. In particular, will the spill's effects alter the age and size structure of prey populations such that individual food items are now smaller?
(b) Adult foraging efficiency. This could be reduced if adults are weakened by ingestion of petroleum (perhaps inducing anemia?).
(c) Distance prey must be transported to the colony. If parents must now transport food over distances much greater than the usual, they will require more food themselves, and will on average deliver food to chicks at longer, less frequent intervals.
(d) Transport ability of parents. If adults are weakened by petroleum ingestion (perhaps inducing anemia?), will their poorer condition also translate to longer, less frequent food delivery intervals.

Are chicks really only fed during a specific 5-hour period of the day? If petroleum contamination has altered the adults condition, it might also alter the feeding schedule. Watches alone cannot measure amount (size, mass) of prey per delivery.

This group probably has the greatest appeal to tourists, which enhances their "intrinsic value". Great care should be taken in generalizing from guillemots to puffins, auklets and murres. While they are all diving birds which sit on the water, they vary both in the depth of their dives and the distance at which they feed from the islands. The inshore feeding habits of the guillemots might make them more vulnerable if the spill happened near their colony, but less vulnerable if the colony was more remote. Such colonies could prove useful controls, especially if the guillemots stay near the breeding colony throughout the year.

Suggestions: At oiled and control colonies all birds examined should be weighed and bill, tarsus, and wing chord measured in order to document overall physical condition of chicks and adults, and whether there is any abnormality in development of chicks. Conduct more detailed field work to measure provisioning, including continuous watches of several nests and periodic weighings of chicks during the feeding hours for several consecutive days in order to determine the feeding intervals and payload sizes. Underweight chicks might be getting as much food as ever, and low body mass might be due to toxic effects of petroleum ingestion. Also, through observation, it may be

possible to compare oiled vs. non-oiled parents at the same colony. Effects on hatching success and success in rearing young could also be compared- that is if guillemots with oiled plumages survive long enough to attempt breeding. Also consider conducting a similar study with puffins or murres which feed further from colonies.

Bird Study 10. Assessment of Injury to Glaucous-Winged Gulls using Prince William Sound

Comments contributed by Dr. Wayne Hoffman, Biologist, Department of Field Research and Dr. Stephen Kress, Principal Investigator, Department of Field Research

This appears to be a straight-forward, well-thought-out study. Nevertheless, the assumption that the Glaucous-winged Gull "generally represents" scavenging passerines (corvids) is incorrect. In the first place, their physiology is different (e.g. salt excretion). Secondly, different habits (swimming vs. not) greatly affect the thermal consequences of light oiling. Thirdly, differences in plumage thickness and texture, and uropygial gland oil amount and properties could have major unpredictable effects on oiling consequences.

As with almost all the proposals, this study should definitely be updated to include the 1990 field season. We think the egg analysis work will be particularly valuable. We also suggest that this study include growth studies of chicks reared by oiled and non-oiled parents. Because of the previous work done with this colony, this could be an especially useful study.

We foresee one potential confounding factor: the closing of the fishing seasons in Prince William Sound may have major effects on the gulls' food supply, thus reducing productivity in a less direct manner.

Bird Study 11. Injury Assessment of Hydrocarbon Uptake by Sea Ducks in Prince William Sound and the Kodiak Archipelago

Comments contributed by Dr. Fred Schaffner, Biologist, Department of Field Research

A basic assumption of this study seems to be that short-term effects observed in other species (seabirds) will translate to long-term effects in sea ducks. The term "reproductive potential" is not adequately defined and there is no indication in the methods as to how this will actually be measured. Similarly, it is not clear what is meant by "intrinsic values", nor is it stated in the methodology how this will be measured. In addition, how will birds be collected, and how many will be collected?

Bird Study 12. Assessment of Injury to Shorebirds Staging and Nesting in Rocky Intertidal Habitats of Prince William Sound and the Kenai Peninsula

Comments contributed by Dr. J.P. Myers, Senior Vice President for Science & Sanctuaries, Dr. G. Thomas Bancroft, Principal Investigator, Department of FieldResearch and Dr. Carl Safina, National Raptor Coordinator and Principal Investigator, Department of Field Research

The most important part of this study as estimated by the potential impact on numbers is Item G, as by far the majority of shorebirds using the Sound and likely to be affected by the spill are those that breed in western Alaska. It is not clear from the description of the work, however, whether the studies enabled by previous base line data are anything more than a shot in the dark, given the vastness of the breeding area. Were baseline data available on fall migration indices of breeding season success then it might be possible to gain insight as to whether the 1989 summer productivity was comparable to pre-spill years. Individual researchers working along the US Pacific flyway may have such results (see Point Reyes Bird Observatory or Bodega Marine Laboratory). Useful information might also be gleaned with a thorough review of selected Audubon Christmas Count data on well-known sites in Oregon, California, or Washington, combined with field work in the 1989-90 winter.

On the whole, the remaining objectives of the study appear good and complete. Methods for the remaining parts of the study, however, lack sufficient detail to determine if the objectives can be met. For instance, how can "the minimum proportion of shorebirds" as discussed in objective C actually be measured? As stated, it does not appear to be a realistic objective and the methods section provides no further clarification.

The historical data for the area will be important for determining if shorebirds avoid contaminated beaches. If shorebirds become overly concentrated on "clean" beaches, food shortages might lead to

delayed migration and breeding. The census techniques need to be carefully set up to be sure they are providing repeatable estimates. No information was given on the technique.

The species mentioned as having individuals captured and marked was surfbirds and the reason for this was unclear. It seems that other breeding (oystercatchers) and migrant species will need to be marked to determine the amount of time individuals were exposed to contaminated beaches. Estimates of the proportion of shorebirds directly contaminated with oil will need to take into account the length of time individuals stay on contaminated beaches and in Prince William Sound. How will these estimates be made; what species will be studied intensely to determine reproductive success at the Sound and further north? No information was given on how breeding success was to be determined. Are body counts to be made and individuals collected to determine the importance of direct mortality by oil?

Bird Study 13. Impact Assessment of the Exxon Valdez Oil Spill on Passerines and Other Nongame Birds in Prince William Sound

Comments contributed by Dr. G. Thomas Bancroft, Principal Investigator, Department of Field Research

This study appears straight-forward, although census techniques were not detailed and those used will be critical for determining the accuracy of population estimates. How will the effects of hydrocarbon levels in tissues be related to health, survival and reproductive potential?

Bird Study 14. Effects on Migratory Birds of Exposure to North Slope Crude Oil

Comments contributed by Dr. Fred Schaffner, Biologist, Department of Field Research and Dr. Stephen Kress, Principal Investigator, Department of Field Research and Dr. Carl Safina, National Raptor Coordinator and Principal Investigator, Department of Field Research

This is purely a contracts proposal, but the contracts budget cannot be evaluated because the contractors are not named.

The methodology is vague. It is unclear whether, or to what extent, otherwise healthy birds will be intentionally oiled. Which species will be examined? How will they be oiled? Basically, the methodology proposed will allow only for a comparison of the pathology of oiling in several species. It is unclear whether the proposed study will allow determination of pathological levels of contamination, and estimation of the lethal thresholds of toxicity. A comparison of fresh vs.weathered oil would also be useful. We further suggest including studies of banded birds to compare inter-year survival in oiled vs. non-oiled areas.

Before new research is initiated concerning the effects of petroleum on seabird physiology, contact David Peakall, Chief, Toxic Chemicals Division, Wildlife Management Branch, Canadian Wildlife Service, Ottawa, Ontario K1A OH3. He has conducted extensive research on the effects of ` on puffins, storm-petrels and other North Atlantic seabirds.

Specific Comments on Damage Assessment Plan .

Comments contributed by Dorene Bolze, Environmental Policy Analyst, Science Division

Part I: Injury Determination/Quantification - Coastal Habitat Injury Assessment

The damage assessment plan appears to focus on the effects of the oil spill to various habitats through the Air/Water studies and the Coastal habitat study. It is very important that a comprehensive assessment be made by habitat as well as by wildlife species, since many species will be greatly affected by the indirect injury to habitat from the spill as well as by direct contact with the oil. Yet, the description of the coastal habitat study gives no details of the 45 types of categories that will be studied. It does not discuss which benthic species will be studied or whether or not kelp beds will be studied, nor does it describe how the other studies will be coordinated with it. This section should also explain how fines will be established based on the damage assessed from the coastal habitat study. In this section and elsewhere in the plan, those studies which compare oiled sites with non-oiled areas, laboratory data and field baseline data should be consistently used. Obviously when evaluating areas that have been oiled where there are no pre-spill data, then the effects need to be compared to a comparable clean site. But, pre-spill baseline data is best and should be used wherever possible.

Part I: Injury Determination/Quantification - Air/Water Injury Assessment

The implication of this section is that studies on the water column will focus on violations of water standards for various pollutants, i.e. hydrocarbons. This is inadequate if this is the only approach to water column issues. Federal and state standards for hydrocarbons are typically based on human health effects only. Although these studies are important in determining fines for violations of the Clean Water Act, etc., the studies also need to focus on determining water concentrations of those components of the oil spill that have biological effects on the wildlife and ecosystems. Though study #3 states this as one of its objectives, it should be a major objective. It appears that study #2 plans to use the same submersible as that used for Fish study #20. In this case a variety of depths should be collected, not just the top 2 cms to determine how the oil has become incorporated into the sediments.

As an alternative it may prove less expensive to use grabs deployed from ships rather than deploying a submersible to collect sediment samples of only the top 2 cms. None of the air/water studies, including study #2, plan to use plots and do wildlife density studies of the benthos. Such plots are used in other studies and are important here to assess the effects of the oil on the bottom sediments. For both studies #2 and #4, it may be possible to estimate the total acreage of bottom sediment oiled and then base the fine on this figure, thus, attempting to assess the fine in terms of the ecological damage rather than just the commercial damage.

Part I: Injury Determination/Quantification - Fish/Shellfish Injury Assessment

Of the 26 proposed studies, this group recieves by far the most attention in the damage assessment plan. The fisheries studies appear to be more concerned with determining the long-term effects of the oil spill than any of the other major study sections. Study #3 directly states the long-term effects of the spill as an objective. This appears to be in contradiction to the introduction of the damage assessment plan, which states that studies are not designed for long-term issues. There is no rationale given for why the three species of clams were specifically selected in study #13. The tremendous lack of information on which species will be studied in the Coastal Habitat Study has made it extremely difficult to evaluate in this study which clam species that are important wildlife food sources have been overlooked. A similar concern is raised for study #26 on green sea urchins. Although this species may be commercially important, they are also an integral part of the marine food chain and affect habitat structure. High sea urchin density keeps kelp bed growth low and thus, lowers a significant source of carbon to the coastal community. Sea otters feed on urchins and as a result kelp bed acreage expands with sea otter populations. This translates into increased biomass production. The plan does not discuss whether these important roles in habitat productivity will be examined either in this study or in the coastal habitat study. One possible means of putting a value on the damage to a kelp bed would be to estimate the reduced number of commercially valuable fish the habitat will not produce until it is restored (or forever). In considering the overall damage assessment plan we are concerned with the fact that both for seabirds and marine mammals a representative species was chosen for study. While for the fisheries, almost every commerical species is targeted for at least one study if not for several studies addressing the effects on various stages of the life cycle (ie., pink salmon). This would appear to be too heavily weighted towards the study of those species that are obviously commerically valuable, while ignoring those species that appear to have only intrinsic values (i.e., fish that are important wildlife food sources, seabirds, wilderness, etc.)

Part I: Injury Determination/Quantification - Marine Mammals Injury Assessment

There is no explanation in this section of why a porpoise species has not been selected for study, or if it is intended that information from the Orca study will be extrapolated to this group of mammals. For study #3 on necropsies, it might be useful to include strandings that occur in the Bering Sea (for the migrating species like the gray whale). Not all effects from the oil spill will be acute and result in strandings in the Gulf unless the migrating individual moves slowly. Depending on the rate of migration, some strandings even as far north as St. Lawrence Island, near where most gray whales feed in the summer, could be a result of exposure to the spill during migration. It is not clear in study #5 on the harbor seal, how the researchers will be able to decipher the effects of the spill from the effects of other stresses that have recently been causing a sharp decline in the harbor seal population. The plan does not explain why there is interest in the long-term effects of the spill on sea otters (study #6) as opposed to the long-term effects on other species. Study #7, does not mention where individual otters to be released have come from, nor the intended release sites. It is not clear whether rehabilitated otters will be released in various areas for comparison (such as non-oiled sites and treated sites.) In addition, the plan does not identify how a fine would be set based on a finding that the sea otter population will be depressed for 5 years. There is no rationale in this section to explain why only seven studies are designed for marine mammals even though numerous other species are identified as potentially being affected. This section also does not clarify whether Exxon will be fined under the Marine Mammal Protection Act or the Endangered Species Act, or whether information from these studies will be available for such consideration.

Part I: Injury Determination/Quantification - Terrestrial Mammals Injury Assessment

Study #6 does not specify whether minks will be exposed only to various concentrations of new crude oil, or also to various weathered samples. Study #5 appears to involve only a minimal effort to trap small mammals (considered here as a food source) on some oiled areas. However, these small mammal studies can give a good idea of the effect of the spill on the food source, which may be as important, if not more, than the larger mammals (predators) actually being oiled or eating oiled carcasses. A more extensive trapping program to determine density should be done at a variety of sites, i.e., clean to heavily oiled areas as well as treated sites.

Part II: Development of the Restoration and Implementation Plans

This section is extremely vague. There is no attempt made to clarify what factors from specific research studies might be considered.when designing specific restoration plans. This section never states whether Exxon or the federal/state agencies will be responsible for the restoration, or further clean-up. If money from the Exxon fines is to be used in the restoration programs, this is not clarified. Moreover, the current restoration plan appears to be primarily geared to restoring only commercial values. This plan is therefore not consistent with the ultimate purpose of the restoration plan, which should be to restore the damaged areas as soon as possible to pre-spill conditions. Although this goal may be unrealistic for some areas, every effort should be made to establish the most efficient and effective restoration plan for each area, population, species and ecosystem damaged by the spill.

Part III: Damage Determination - Economic Value of Resource Use

There is no apparent attempt in this section to deal with tourism directly. For example, Economic study 5 on damage to recreation does not include lost dollars to vendors, hotel owners, etc. from the reduced recreational use. There is no mention of the potential tourist industry losses that could result from a decline in servicing hunting and recreational fishing. Assessing potential lost tourism income is at least a start in evaluating the costs of damage to the wilderness and wildlife. A good analysis of tourism losses is essential in considering a dollar value for the ecological damage incurred in coastal habitats and in wildlife populations that do not have commerical values. Great care should be taken not to overlook these seemingly less tangible values, in favor of a perhaps "easier" route of focussing damage assessment and fines more heavily on those species with direct commerical value.

Appendix B-Histopathology Proceedures

On p. 220 there is a reference to the Mixed Function Oxidase (MFO) enzymatic system which the livers of most higher animal species posess in order to detoxify ingested oil (hydrocarbons). Not only are the original hydrocarbons of the crude oil toxic, but some are actually less toxic than the metabolites from the MFO system. Metabolites in general are more reactive in body chemistry. Yet, there has been little study of the effects of the oil MFO metabolites on physiology. Nonetheless, the histopathology studies should not exclude assaying for these metabolites. The list of hydrocarbons that are required to be identified on Appendix A on page 219 should include the known metabolites of crude oil, and specifically north slope crude.

COMMENTS ON BIRD STUDY NUMBER 6

(B6) MARBLED MURRELETS ($115,700)

This study attempts to assess the impact from the oil spill to marbled murrelets by surveying populations, checking breeding activity, and analyzing 10 birds for contaminants.

Technical Comments

This is one of several studies assessing bird population impacts. The information generated from this study may overlap with other studies. This study and/or possibly some of the other similar studies are research oriented and not necessary to assess natural resource damages, as required in the NRDA regulations.

The details of the experimental and analytical methods used in this study are not available in the description provided. Therefore, it is impossible to determine if: standard and widely accepted methods are employed; possible biases are accounted for; surveys accurately represent assessment areas; possible errors in scaling results are accounted for; and results are statistically valid.

The use of "on-land watches" for determining breeding activities is unconventional. Furthermore, the visibility in most areas of the Sound is often too poor to allow for adequate visual counts.

Although this study mentions some results will be evaluated using statistical procedures, more details of the statistical components being used are necessary to evaluate the approach. In particular, a control size of only one non-oiled site may be too small to be valid statistically.

Regulatory Comments

The study deviates from the regulations, as described by Paragraphs A, B, C, G, H, I, O, S, U, V, X, and Y shown in Tables 3-4 of this document.

COMMENTS ON BIRD STUDY NUMBER 5

(B5) PEALE'S PEREGRINE FALCONS ($43,500)

This study attempts to assess the injury from the oil spill to Peale's peregrine falcons by surveying populations, examining nest and eggs, banding adults, and analyzing feathers and blood.

Technical Comments

This is one of several studies assessing bird population impacts. The information generated from this study is only marginally important to either a damage assessment or recovery efforts. Moreover, since few of the raptors recovered by bird search teams were falcons, and since a substantial raptor study also exists, this study is not necessary or reasonable.

The details of the experimental and analytical methods used in this study are not available in the description provided. Therefore, it is impossible to determine if: standard and widely accepted methods are employed; possible biases are accounted for; surveys accurately represent assessment areas; possible errors in scaling results are accounted for; and results are statistically valid.

The survey techniques of this study deviate from previous studies in that they cover new "suspected nesting territories" on which no historical data are available and they use new methods such as helicopter surveys when previous surveys were conducted from boats. This makes any historical comparisons scientifically invalid.

Further, peregrines are not particularly easy to locate. Surveys, especially using new techniques, need to be performed with particular care to avoid any mistaken conclusions based on inadequate field effort.

The study will utilize methodologies (helicopter observation, trapping of adults in nets, blood sampling, and inspection of nests) to draw conclusions about injuries to these species. There is no indication that these intrusive methodologies will be performed on control groups, so results from this study will be inconclusive.

Regulatory Comments

The study deviates from the regulations, as described by Paragraphs A, B, C, G, H, I, O, S, U, V, X, and Y shown in Tables 3-4 of this document.

COMMENTS ON BIRD STUDY NUMBER 4

(B4) BALD EAGLES ($445,000)

This study attempts to assess the injury from the oil to bald eagles by surveying populations, examining nest and eggs, radio-tagging 60 eagles, analyzing blood samples, and necropsying dead eagles.

Technical Comments

This study is ambitious and methods are not described adequately to evaluate their potential to determine the impacts of oil on bald eagles. It is uncertain if the degree of impact measured is equivalent only to the degree of oiling, or if it also will include characteristics such as short-term avoidance of disturbed areas.

Manipulative methods such as trapping and tagging 60 eagles and collecting blood samples might influence behavior. It is not clear from information provided how these effects can be discerned from oil-related effects. Further, in the analysis of blood samples "to determine contaminant concentrations" there is no definition of what contaminants are.

There is no mention of any results being statistically validated. Without a sound statistical design, any results generated will be inconclusive. In particular, "data from a remote nesting site" implies only a comparison of one such site is made and is likely to be inconclusive.

Regulatory Comments

The study deviates from the regulations, as described by Paragraphs A, B, C, G, H, I, O, S, U, V, X, and Y shown in Tables 3-4 of this document.

COMMENTS ON BIRD STUDY NUMBER 3

(B3) SEABIRD COLONY SURVEYS ($440,000)

This study attempts to determine the population of seabird nesting colonies by surveys.

Technical Comments

This is one of several studies assessing bird population impacts. The information generated from this study may overlap with other studies. This study and/or possibly some of the other similar studies are more research oriented and not necessary to assess natural resource damages, as required in the NRDA regulations.

The details of the experimental and analytical methods used in this study are not available in the description provided. Therefore, it is impossible to determine if: standard and widely accepted methods are employed; possible biases are accounted for; surveys accurately represent assessment areas; possible errors in scaling results are accounted for; and results are statistically valid.

This study focuses on cliff-nesters and ignores crevice- or burrow-nesters. An unstated assumption that cliff-nesters and burrow/crevice-nesters are affected equally by the spill and its aftereffects is not tenable. Hence, no simple extrapolation to these birds should be done.

Although this study mentions that some results will be evaluated using statistical procedures, more details of the statistical components being used are necessary to evaluate the study design. One or two surveys conducted sometime during the previous 17-year period are scarcely an adequate base on which to calculate possible reductions in breeding colony sizes that can be related to oil spill effects.

Regulatory Comments

The study deviates from the regulations, as described by Paragraphs A, B, C, G, H, I, O, S, U, V, X, and Y shown in Tables 3-4 of this document.

COMMENTS ON BIRD STUDY NUMBER 2

(B2) CENSUSES AND SEASONAL DISTRIBUTION ($565,000)

This study attempts to determine the distribution and abundance of migratory birds by surveys.

Technical Comments

This is one of several studies assessing bird population impacts. The information generated from this study may overlap with other studies. This study and/or possibly some of the other similar studies are more research oriented and not necessary to assess natural resource damages as required in the NRDA regulations.

The details of the experimental and analytical methods used in this study are not available in the description provided. Therefore, it is impossible to determine if: standard and widely accepted methods are employed; possible biases are accounted for; surveys accurately represent assessment areas; possible errors in scaling results are accounted for; and results are statistically valid.

Insufficient information is provided to evaluate if this study can determine that any reduction observed in oiled areas represents actual mortality or simply movement out of the area.

Details on the statistical treatment of the data are not provided in this study; thus it is impossible to determine if any results will be conclusive. Conclusions may be compromised by the intention of using unproven "new" aerial survey techniques and historical data as a basis for injury determination.

Regulatory Comments

The study deviates from the regulations, as described by Paragraphs A, B, C, G, H, I, O, R, S, V, X, and Y shown in Tables 3-4 of this document.

COMMENTS ON BIRD STUDY NUMBER 1

(B1) BEACHED BIRD SURVEY ($258,000)

This study attempts to estimate bird mortality related to the oil spill by applying correction factors to actual bird mortality observed.

Technical Comments

The details of the experimental and analytical methods used in this study are not available in the description provided. Therefore, it is impossible to determine if: standard and widely accepted methods are employed; possible biases are accounted for; surveys accurately represent assessment areas; possible errors in scaling results are accounted for; and results are statistically valid. The study neither defines nor explains how the "minimum mortality" will be used in the final "overall mortality of waterbirds" estimate. In addition the number, locations, and methods of the "systematic survey" should have been provided in the Draft since this information was readily available.

There is insufficient information presented in the Draft to evaluate whether the methodological and analytical strategies are sound. The objectives require the implementation of flotation and scavenging experiments. These types of studies require assumptions and subjective determinations, and it is critical that more detail be provided and reviewed by all concerned parties. Also, the means by which adjustments to total mortality from the oil spill will be made to account for natural mortality will need careful and expert consideration.

There is no mention of any results being statistically validated. Without adequate statistical design, any results generated will be inconclusive.

Considering the high degree of subjectivity of this study and the objective to calculate "overall mortality in conjunction with bird population surveys and seabird colony censuses," there is a strong possibility the external influences of these other studies will dictate correction factors, thus compromising the usefulness of this study. Moreover, any mortality estimates will be nothing more than rough order-of-magnitude approximations.

Regulatory Comments

The study deviates from the regulations, as described by Paragraphs A, C, Q, S, and U shown in Tables 3-4 of this document.

VII. COMMENTS ON THE BIRD INJURY ASSESSMENT PROGRAM

The Draft describes fourteen studies costing $2,755,700 (not including any analytical cost) to evaluate the injury to the bird resources. One study estimates waterbird mortality for $258,000. Two studies survey bird populations for $1,005,000. The remaining eleven studies total $1,492,700 and collect more general information and detailed data on particular species.

Some bird studies are needed, but this program is not focused on information necessary to restore bird resources and goes far beyond collecting information necessary to assess injury. Instead, the multiple studies appear to be a research program designed to expand the information available on the many different species in the area, thus ignoring the proper use of indicator species as required in the regulations. Because of the research focus, much of this program is not NRDA related.

A detailed program such as this is clearly not warranted. Because of natural variability, the mobility of birds, the migratory nature of some species, and the vast area of interest, any conclusions on injury to birds attributable to the oil spill can only be a rough approximation. Further, when considering the large, healthy populations of bird species unimpacted by the spill, the primary restoration mechanism is natural recovery.

The Draft fails to provide any details of the methodologies used in the studies, making a rigorous review impossible. However, from the brief description available, many of the studies appear poorly designed and will produce questionable conclusions. Although it is stated that "many studies will use unaffected control areas for comparison" (p. 144), poor study design may make these comparisons statistically invalid.

15.4.1

Wurtz

01
03

Trustee Council
P. O. Box 20792
Juneau, Alaska 99802

August 25, 1989

Dear Sirs:

I am very distressed about the document I have in front of me, the "State/Federal Natural Resources Damage Assessment Plan for the Exxon Valdez Oil Spill." While the research proposed appears to be relatively well thought-out, there is one critical flaw to the entire plan: The is no way this damage assessment can be properly completed by February 28th, 1990.

Com.	Topic	Issue	Sug.	Sort
1	4	0201		2

Consider, for example, the Coastal Habitat Injury Assessment study plan. On pages 31 and 32 the plan states that between 135 and 150 study sites will be required to properly assess damages in all three geographic areas affected by the spill. Since the so-called "reconnaissance phase" of this project has only just been started, few of those 150 study sites have been identified to date, and fewer still have been visited for the purposes of damage assessment. It is well known that little field work can be done in Prince William Sound after September 15, due to increasingly rough weather conditions. To suggest that 150 sites can be identified, ground-truthed and assessed for damages between now and next February is a joke!

If the Trustee Council allows this deadline to stand, the assessment of damages from the Exxon Valdez Oil Spill will turn out to have been a meaningless bureaucratic paper shuffle. The Trustee Council will have been criminally negligent in its responsibilities to the people of this country.

Sincerely,

T. L. Wurtz

T. L. Wurtz
P.O. Box 82864
Fairbanks, Alaska 99708

AUG 30 '89

A	I	PAO	In'ls
		Nicolls	
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Schaetler
912554
03

August 21st, 1989

Robert Mosbacher
Dept. of Commerce
14th St.
Washington D.C. 20230

This letter is to explain my concern about the lack of research being conducted regarding the beach animals on Kodiak Island.

The effect of the Exxon Oil spill on Kodiak Island has been tremendous. Oil from the spill has been found on every part of the island in every bay and nearly every beach.

To date, nearly 20,000 birds have been found in the Kodiak Island area. The number of birds have not begun to diminish. If anything, the amount of dead birds found daily may still be on the rise. These birds are not full of oil, they are just dead or near death. Also, these birds are not confined to one species. They are of all species.

No one knows how many have really died, but one must assume that the rate of discovery in not very high when the size of the Gulf of Alaska is considered. For these birds to be dead and yet visually untouched by oil, makes me believe that the effects must be either secondary, eating fish already exposed, or through oil affected aquatic plants.

During late July, a small lagoon was found with a circle of dead fish six inches deep and fifty feet in diameter. The whole lagoon is contaminated with thick mousse as is the bay in front of the lagoon. On August 5th, a dead land otter was found in Tonki Bay on North Afognak Island, 40 miles NNW of Kodiak. A dead fox was found in mid-July in Phoenix Bay, also on North Afognak west of Tonki Bay.

As Exxon leaves and the winter storms begin, These dead birds will still be washing up on the beach. The Kodiak Island fox is the largest fox in the world and is also the animal that makes the most use of the beach. After the freeze begins, food becomes more scarce as the winter progresses. Mice, birds, bugs and vegetation that make up the foxes diet cease to be available. The fox then turns to the beach for his food. Both the beach and the "drift" food are contaminated by oil. If the limpits, bidarkes, and other marine life from the beach are effected by oil, the foxes and the otters will be effected as this marine life becomes an important food source for both animals. The fox depends on scavaging for much of his diet, but he is not alone in this type of feeding. Many birds including magpies, crows, ravens, hawks, eagles and several shore birds depend on this same contaminated source for a portion of this diet.

The land otters are eating all of this same marine life plus fish of all kinds. As the oil contamination is spread and ingested by these animals of the beach, who knows what the effects will be or how far reaching.

There is a study going on in Prince William Sound concerning land otters. But that is Prince William Sound, not Kodiak! As far as I know, there is no plan or ongoing project to study the life on the beach that may be more affected than you can realize.

I have lived on Kodiak and it's outer islands for 17 years. I am a commercial fisherman and trapper. I have spent many years living on the beach with these same animals and I understand life in that environment very well. I contend that this is and will be a very big problem that may affect life at this level for a long time.

We need a study on these animals here in the Kodiak Archipelago. I believe it should be done during the winter months when the animals are most concentrated and the contaminated food is a larger part of their diet.

Com.	Topic	Issue	Sug.	Sort
2	4	1750		1

I have sent this letter to other state and federal agencies and departments in addition to private organizations. Please save this for reference in case future discussions on these issues take place.

If you would like to talk to me about these concerns, please get in touch with me. I would like to be part of this study which must ultimately be done!

Sincerely,

Bruce Schactler

Bruce R. Schactler
P.O. Box 2254
Kodiak, AK 99615
907/486-4686

15.2.1

34

August 6, 1989

To: Carolyn McCormick, DVM
Seward Otter Rescue
From: P. Wunnicke, staff
Re: Drawing bloods/implanting radio transmitters at Jakolof pre-release facility.

Carolyn, as you are well-aware ,there are serious questions about the propriety and necessity of subjecting the otters at the Jakolof pre-release faciltiy to further trauma and stress associated with both the blood drawing process and the surgical implantation of transmitters.

Specifically, dipnet capture trauma (to teeth, gums, and nose due to lacerations from dipnet mesh), risk of adverse reaction to sedative or reversal drugs, internal injury from capture box handling, and the possiblity of accidentally dropping an otter are of utmost concern. Further ,I am concerned about the possiblity of veinous and arterial puncture and lacerations, to say nothing of the possible infection and complications inherent in the process of abdominal surgery.

Con.	Topic	Issue	Sub.	Sort
1	3	1660	X	2

Perhaps most vulnerable of all are the pregnant females now being held at Little Jakolof. Exposing them and their fetuses to the effects of drugs, undue handling and stress for the sake of completing a data set is poor husbandry practice and borders on the immoral. This sub-population has already been designated for "soft release" in Kachemak Bay, several pregnant females have already been released without blood draws, and the remaining pregnant females should be released in the same fashion ASAP.

As per professional consult with Dr. Glen Grady, DVM, the data necessary to determine the relative health of the Jakolof otter population vis a vis infectious disease can be obtained through a representative blood draw sample. Dr. Grady suggested a 25% population sample size.

This is good news if,in fact, it is true and if this means the release will now be accelerated so as to no longer compromise either the health or freedom of the tested otters now being held at Little Jakolof.

Representative samples are commonly used for precisely this type of research. I am not averse to cooperating with the U.S. Fish and Wildlife Service and the AK. Department of Fish and Game, to insure that the re-introduction of captive otters presents as few risks as possible to both the wild population and to those that have transitted the otter rehabilitation facilities.

The more invasive procedure of surgically implanting recovered otters with radio transmitters is of even graver concern. While the risks are high the possible benefits are dubious at best. The use of radio tansmitters, on otters in Valdez, to determine a "safe" release site was demonstrably valuable in protecting all the as yet to be released otters from being released too close to an oiled area. Fish and Wildlife has not been forthcoming with ANY evidence demonstrating positive impacts of radio tagging Jakolof otters either on an individual basis or for the benefit of the population as a whole. In point of fact, nothing we need to know to expeditiously and safely release these otters can not be determined from the results of the already tagged Sheep's Cove release.

Further, Fish and Wildlife has refused to come forth with any evidence or justifiable argument for radio implantation deeming such discussion "not open for public review." One must question whether this public agency really has a valid argument supporting its proposed administration of radio implantation or not.

Because of these concerns I strongly urge you to raise your voice in advocating for both full disclosure from the U.S. Fish and Wildlife Service and for the use of only absolutely necessary invasive veternary procedures that will CLEARLY benefit the otters. Man has caused enough trauma for these hapless creatures we must now mitigate the damage done not cause further harm.

Your consideration of this position and advocacy for the dignity, safety and freedom of these otters is much appreciated.

Sincerely,

Paul Wunnicke

Paul Wunnicke

Kasitsna Bay

Seldovia Alaska

6 April 1989

Oil Spill Response Requirements Related to Marine Mammals

At least seven species of marine mammals inhabit or occur seasonally in Prince William Sound, Alaska. They could all be affected adversely by the oil spill and related containment and clean-up operations resulting from the grounding and rupture of the supertanker Exxon Valdez on 24 March 1989. The species include: the sea otter (Enhydra lutris); the northern or Steller sea lion (Eumetopias jubatus); the harbor seal (Phoca vitulina); the harbor porpoise (Phocoena phocoena); Dall's porpoise (Phocoenoides dalli); the killer whale (Orcinus orca); and the humpback whale (Megaptera novaeangliae). In addition, many more sea otters and several other marine mammal species, including the gray whale (Eschrichtius robustus) and the northern fur seal (Callorhinus ursinus), could be affected by oil now moving towards the Gulf of Alaska.

Some effects of the oil spill and related operations may be immediate and obvious, while others may be less apparent and occur over long periods of time. For all of the species, immediate effects may include mortality or morbidity due to:

- contact with oil and/or chemical dispersants (most likely to affect sea otters and fur seals that depend upon fur to insulate them from cold water);
- inhalation of fumes as volatile components of the oil evaporate (could cause respiratory distress in all species);
- direct ingestion of oil and dispersants or ingestion of oil- or dispersant-contaminated prey (most likely to affect sea otters that could ingest oil in the process of grooming and eating shellfish from contaminated shellfish beds, baleen whales whose food filtering baleen plates may be fouled by oil and cause large quanitities of oil and oil contaminanted food to be ingested, and seals and sea lions that feed on fish that may have become easier to catch because oiling affects their ability to evade capture);
- disruption of mother-pup bonds or transport of toxic substances from parent to offspring through the mother's milk and from the skin/fur of an oiled mother (nursing

seal, sea lion, and sea otter pups, and cetacean calves); and

- increased vulnerability to predation (sea otters, sea lions, and seals preyed upon by killer whales, sharks, and eagles).

Long-term effects on all species may include such things as premature pupping, increased incidence of spontaneous abortion, congenital and genetic birth defects, mortality, and morbidity. These may be caused by such things as direct exposure to toxic dispersant and hydrocarbon compounds, eating fish and shellfish that have picked up and accumulated toxic compounds by absorption or ingestion of tainted prey, starvation due to reduction of food supplies, and destruction of kelp beds which may be essential for successful rearing of sea otter pups.

Needed Actions

Several different types of response action are required--

1. where possible, animals in danger of death due to contact with oil must be located, cleaned, rehabilitated, and held until fit for release either at the original capture sites once the spill is cleaned-up or in new, uncontaminated areas;

2. beach, boat, and aerial surveys must be conducted to document when, where, and how many animals may have been exposed to spilled oil, and how many are killed or debilitated by the contact;

3. complete necropsies--including histopathology, toxicological screens, and stomach content analyses--must be done on representative samples of all species found dead in or near areas exposed to oil or dispersants to document cause of death (this program should be initiated immediately and should be continued periodically until there is no discernible evidence of anthropogenic hydrocarbon compounds in tissue samples from animals found dead in areas affected by the spill, or in the marine food webs of which the various species are a part);

4. directed and opportunistic studies must be done to:

   a. test and evaluate possible alternative methods for avoiding oiling and for capturing, handling, cleaning, and rehabilitating oiled sea otters, sea lions, harbor seals, and fur seals;

b. determine how various species behave in the vicinity of spilled oil and containment/clean-up operations (e.g., do animals appear able to detect and avoid, or are they attracted or indifferent to, spilled oil and containment/clean-up operations; what happens to animals after they are oiled--do they remain in or move from areas where they were oiled, do they haul out on land, do they groom and ingest oil in the process, do they die and sink to the bottom or float);

c. determine whether various species are more or less likely to eat oil contaminated or uncontaminated prey (e.g., are there any indications that oil affects fish in ways that make them easier to catch and more likely to be eaten by seals, sea lions, and cetaceans, or that any species refuse to eat oil-contaminated prey); and

5. long-term (five-, ten-, twenty-year) studies must be designed and carried out to determine: (a) the chronic, long-term effects of the spill on various species and key components of their habitat; (b) how the spill affected the demography and reproductive capacity of the various species; and (c) the manner and rate that the affected species and habitats recover from the impacts of the spill and associated activities.

Sea Otters

Because oiling of a sea otter's fur compromises its insulative value and because sea otters depend upon fur for insulation, sea otters are the species most likely to be affected adversely by contact with spilled oil. In 1985, Randall W. Davis, Ph.D., and colleagues at the Hubbs Marine Research Institute in San Diego, California, carried out a study, under contract to the Pacific Office of the Minerals Management Service, to develop and test possible methods for restraining, cleaning, and rehabilitating oiled sea otters. The study results, described in a May 1986 report to the Minerals Management Service, indicate that oiled otters can be effectively immobilized for cleaning using a combination of meperidine hydrochloride and diazipam and that oil can effectively be removed from immobilized otters by washing for 40 minutes with a 1:16 solution of Dawn liquid detergent in water, followed by 40 minutes of rinsing with a shower head under moderate pressure.

Cleaning removes natural as well as foreign oils and, following cleaning, the otters must be dried, kept warm, fed, and given veterinary care to prevent or treat hypothermia, shock, and secondary disease, such as pneumonia. Recovery from the stress of oiling and cleaning takes one to two weeks, providing no secondary medical problems develop. This suggests that animals must be kept in warm water holding facilities for one to two weeks before

release to insure a reasonable probability of post-release survival.

In addition to the fact that these restraint and cleaning techniques have not been tested under field conditions, there are other uncertainties. It is not known, for example, whether oiled otters are likely to remain in oil contaminated areas, haul out on land, or attempt to find and move to oil-free areas. It is also not known whether oiled otters can be captured effectively, using standard capture techniques, before they are so debilitated that successful rehabilitation would be unlikely; whether there is some critical time period after which rehabilitation efforts are likely to be unsuccessful; and whether otters that die as a result of oil contamination are likely to be found hauled out on remote beaches, found floating in the water, or not found at all. Consequently, there presently is no basis for predicting what proportions of oiled otters are likely to be found, either dead or alive, for predicting which animals are or are not likely to survive the additional stress of capture, cleaning, and subsequent holding, or for predicting what capture, cleaning, and rehabilitation techniques most likely will be successful.

To resolve these uncertainties, while at the same time capturing, cleaning, and rehabilitating as many oiled sea otters as possible, the following should be done--

1. aerial and/or boat surveys should be conducted to identify (a) areas where sea otters have been and are being oiled, and (b) areas where sea otters have not yet been, but are likely to be oiled;

2. a representative sample of sea otters should be radio-tagged and followed in one or more areas where otters have not, but likely will be, contacted by oil to determine what otters do and where they go after they are oiled--e.g., do they haul-out on remote beaches, do they ingest significant quantities of oil while grooming, do they remain at sea and sink or float after death, are they eaten by eagles or killer whales (among other things, this is necessary to determine where to look for oiled otters and to estimate the number of otters killed but not found);

3. benthic communities should be sampled in one or more of the selected study areas, before and at periodic intervals after the areas are contaminated with oil, to determine how the quantity and quality of sea otter prey (food) species are affected by the spill and related activities such as the use of chemical dispersants;

4. scientists familiar with the seasonal distribution and movements of sea otters in Prince William Sound should be consulted to identify important feeding, resting, and breeding areas that possibly could be protected by deploying oil containment booms, and, where feasible, containment booms should be deployed to prevent oil from reaching these areas (this and the succeeding task should be afforded high priority if oil threatens high density sea otter areas in Prince William Sound, the Kenai Peninsula, the Kodiak/Afognak Island area, or lower Cook Inlet);

5. a contingency plan should be developed, and necessary authorization should be obtained, to capture and relocate large numbers of otters in the event that the spill approaches high-density sea otter areas in eastern Prince William Sound, the Kenai Peninsula, the Kodiak/Afognak Island area, or lower Cook Inlet and thus threatens to jeopardize the continued existence and viability of these sea otter populations;

6. an additional facility or facilities should be established to clean and rehabilitate oiled otters (the Valdez facility may well not be able to handle all the animals that are oiled, and it may be useful to have a similar facility in Cordova to take care of animals nearer there);

7. scientists, technicians, and veterinarians, including the Fish and Wildlife Service's southern sea otter group, who are experienced in capturing, sedating, cleaning, and caring for sea otters, should be brought in to help staff the facility(ies), train volunteers, and assist in tagging, capture/transportation, and habitat assessment activities;

8. a sufficient number of boats and aircraft should be dedicated to searching for, capturing, and transporting oiled sea otters (and other marine mammals and sea birds) to designated rehabilitation centers; standard procedures should be established for reporting, recording, and responding to reports of oiled sea otters; and possible alternative methods for capturing, handling, sedating, cleaning, and caring for oiled otters (and other marine mammals) should be evaluated and kept under continuing review;

9. all otters handled should be marked with individually recognizable tags, and a subset of rehabilitated otters should be radio-tagged and followed after release to determine what proportion survive and whether any or all

of the animals attempt to return to areas where they may again be oiled;

10. persons with first-hand knowledge of the distribution, movements, habitat requirements, and historic range of sea otters in Alaska should be consulted to identify areas suitable for releasing rehabilitated otters (in this regard, it should be kept in mind that releasing otters in areas already occupied could cause populations to be increased above carrying capacity, damage habitat, and result in more, rather than less, sea otter mortality);

11. a veterinary pathologist should be on site to do necropsies and properly prepare and preserve specimen materials for subsequent laboratory examination so as to try to document the cause or causes of death; additional veterinarians, experienced in sea otter biology and medicine, should be brought in, if needed, to assist with rehabilitation efforts and necropsies; tissue and stomach content samples should be collected, under the supervision of a veterinary pathologist, and be provided to the Fish and Wildlife Service's Veterinary Services Laboratory in Madison, Wisconsin, or other qualified, independent laboratories, to conduct histopathological and toxicological analyses; and this work should be continued until there is no evidence that oil or chemicals used to disperse the spill are causing or contributing to sea otter mortality;

12. skulls (or teeth) and reproductive tracts should be collected from all otters found dead in or near areas contacted by the oil spill; these should be marked with sequentially numbered tags indicating when and where they were collected; and they should be examined by qualified biologists to determine the ages, reproductive history, and reproductive condition of the animals at the time of death;

13. beaches where sea otter carcass counts have been conducted in the past should be identified and walked periodically to gather information on the number of animals dying or washing up dead on these beaches; these data should be compared with data collected previously to estimate the increase in mortality rate and total mortality possibly attributable to the oil spill; and

14. a planning meeting or workshop--to include outside experts as well as marine mammal biologists from the Fish and Wildlife Service, the National Marine Fisheries Service, the Alaska Department of Fish and Game, and the Marine Mammal Commission--should be organized and held within the next three to six weeks to (a) identify the

types of studies needed to document the long-term effects of the spill on sea otters and other marine mammals, and (b) describe the time, money, and special logistic support needed to do the necessary studies.

Seals and Sea Lions

Harbor seals and Steller sea lions, which rely on blubber for insulation, are less likely to be affected by oiling than are sea otters and fur seals which rely on fur for insulation. As with sea otters, contact with oil may irritate the skin and eyes, and inhalation of volatile components may cause respiratory distress and death. In addition, odor seems to be the primary means whereby harbor seal and sea lion females identify their pups so that, if the spill is not cleaned up by the time the pupping season begins, oiling could disrupt the mother-pup bond and cause abandonment and death of pups. Further harm to pups may result from the ingestion of harmful compounds while nursing. In addition, aircraft overflights and containment/clean-up operations in the vicinity of pupping and breeding colonies may interfere with pupping and breeding, and cause stampedes in which pups may be killed or abandoned. Harbor seals, fur seals, and Steller sea lions may be affected adversely by eating oil-contaminated prey and by reduction of available food supplies.

It is not known whether harbor seals, fur seals, or Steller sea lions, suffering from contact disorders, respiratory distress, or the effects of ingesting oil or oil contaminated prey, will haul out on land, remain in oil contaminated areas, or abandon those areas. It also is not clear whether affected adults and pups can be identified, captured, and rehabilitated successfully.

To resolve these uncertainties, while at the same time minimizing the possible adverse effects of the oil spill on harbor seals, fur seals, and Steller sea lions, the following should be done--

1. persons operating helicopters, small planes, and boats as part of the oil spill response effort (or to obtain photographs for news media coverage) should be advised that operations in the vicinity of harbor seal and Steller sea lion rookeries may cause adults to trample pups and to stampede into oil contaminated water and that such disturbance is illegal unless it has been authorized by the National Marine Fisheries Service as necessary for efforts to assess or minimize the possible adverse effects of the spill;

2. aerial and boat surveys should be conducted to:

   a. identify haul-out areas that have been or may be contaminated by spilled oil;

b. locate and, as appropriate, capture animals that appear to be distressed; and

c. observe animals in and near oil contaminated areas to determine if they appear to detect, avoid, be attracted to, or be indifferent to spilled oil;

3. facilities and protocols should be established for examining and treating fur seals, harbor seals, and sea lions that appear distressed (this should be done in cooperation with the sea otter rescue/rehabilitation program outlined earlier);

4. a representative subset of any harbor seals, fur seals, and sea lions found dead in and near areas contacted by oil should be collected and necropsied by an experienced veterinary pathologist to try to document the cause or causes of death. As part of the necropsies, tissue and stomach content samples should be properly collected, and preserved and then sent to qualified laboratories for histopathological and toxicological analyses. If necessary, blood samples and tissue biopsies should be collected from live animals, and/or a small subset of affected animals should be sacrificed, to verify tentative conclusions or hypotheses concerning the nature and etiology of oil-related effects. All animals handled and released should be tagged with individually recognizable tags. A subset of these animals should be radio tagged and tracked to assist in determining post-release behavior and survival;

5. skulls (or teeth) and reproductive tracts should be collected from all animals found dead in or near areas contaminated with oil. These should be marked with sequentially numbered tags indicating when, where, and under what circumstances the animal was found, and should be examined by qualified biologists to determine the ages, reproductive history, and reproductive condition of the animals at the time of death;

6. beaches near known harbor seal and Steller sea lion haul-out and feeding areas should be walked periodically to gather information on the number, sex, and relative sizes of animals dying or washing up dead on these beaches; and

7. as noted earlier, a planning meeting or workshop should be organized and held within the next three to six weeks to identify the types of studies needed to document the long-term effects of the spill on harbor seals, fur seals and Steller sea lions, as well as on sea otters and other marine mammals. This meeting should include outside

experts as well as marine mammal biologists from the National Marine Fisheries Service, the Fish and Wildlife Service, the Alaska Department of Fish and Game, and the Marine Mammal Commission. Meeting participants should: (a) identify the types of studies needed to document the long-term effects of the spill on harbor seals, fur seals, Steller sea lions, and other marine mammals; and (b) describe the time, money, and special logistic support needed to do the necessary studies.

Cetaceans

Killer whales, Dall's porpoise, and harbor porpoise are the cetacean species most likely to be present in significant numbers in Prince William Sound at this time of year. In the summer, significant numbers of humpback whales also may be present. As oil moves into the Gulf of Alaska, it could contact a large proportion of the eastern Pacific gray whale population as gray whales migrate through the Gulf to their summer feeding grounds in the Bering, Chukchi, and Beaufort Seas.

Experiments with captive bottlenose dolphins (Tursiops truncatus) suggest that oil contacting the external surface of cetaceans may have only transitory effects such as irritation of the skin and eyes. This may be in part because healthy cetaceans spend relatively little time at the water surface where they may come into contact with spilled oil or inhale volatile oil fragments, and because oil may be washed off as the animals dive and swim through the relatively clean water below the surface slick.

As a result, the greatest threats to cetaceans may be baleen fouling, ingestion of oil contaminated prey, or reduction of available food supplies. In this context, killer whales may be at greatest risk because they prey upon seals and sea lions which may be more vulnerable to predation if they are oiled, and which may retain relatively large quantities of oil on their pelage. Also, debilitated animals may spend more time at the surface and thus be more susceptible to problems caused by contact with oil and inhalation of volatile oil components.

The Prince William Sound oil spill should be used, to the gretest extent possible, to verify experimental results and assumptions concerning the possible direct and indirect effects of oil spills and related containment/clean-up operations on cetaceans. Towards this end, the following should be done:

1. aerial, boat, and beach surveys should be conducted to:

    a. locate, identify, and determine the numbers and relative sizes of cetaceans present in and near areas affected by the spill;

b. determine how various species behave in the presence of oil--e.g., look for evidence that any or all species can detect the presence of oil, avoid or are attracted to oil or containment/clean-up operations, or are attracted to and feed upon fish, seals, sea lions, sea otters, or other cetaceans whose behavior and vulnerability to capture are altered by oiling;

c. determine if behavior or apparent effects appear related to the quantity or characteristics of oil present (e.g., do behavior or effects appear different in areas covered with light sheens of unweathered oil compared to areas covered with thick coatings of weathered oil);

d. when feasible and the possibility exists of either saving an animal or gaining valuable information, capture, treat, and/or collect samples from animals that appear to be distressed; and

e. determine the number of dead cetaceans washed up on beaches or floating in and near areas affected by the spill;

2. protocols should be established and, as practicable, arrangements should be made for holding, examining, and treating animals that appear distressed;

3. all, or a representative subset of cetaceans found dead in and near areas contacted by oil, should be necropsied by an experienced veterinary pathologist to try to document the cause or causes of death. As part of the necropsies, tissue and stomach content samples should be collected and sent to qualified laboratories to conduct histopathological and toxicological analyses. If necessary, blood samples and tissue samples should be collected from live animals and/or a small subset of affected animals should be sacrificed to verify tentative conclusions or hypotheses concerning the nature and etiology of oil-related effects. All animals handled and released, dead or alive, should be marked or tagged to permit individual recognition if they are seen again, either dead or alive. If feasible, a subset of both live and dead animals left in the water should be radio tagged and tracked to determine what happens to them;

4. teeth or baleen, ear plugs, and reproductive tracts should be collected from all cetaceans found dead in or near areas affected by the spill and related containment/clean-up operations. These should be marked with sequentially numbered tags indicating when, where, and under what circumstances the animals were found, and

they should be examined by qualified biologists to determine the ages, reproductive history, and reproductive conditions of the animals at the time of death;

5. as noted earlier, a planning meeting or workshop should be organized and held within the next three to six weeks to identify the types of studies needed to document the long-term effects of the spill on cetaceans, as well as on sea otters and other marine mammals. This meeting should include outside experts as well as marine mammal biologists from the National Marine Fisheries Service, the Fish and Wildlife Service, the Alaska Department of Fish and Game, and the Marine Mammal Commisison. Meeting participants should: (a) identify the types of studies needed to document the long-term effects of the spill on cetaceans and other marine mammals; and (b) describe the time, money, and special logistic support needed to do the necessary studies.

* * * * *

To summarize, the Commission's major short- and long-term concerns with respect to marine mammals relate to: minimizing the number of animals that are oiled; when appropriate, catching, cleaning, rehabilitating, and releasing animals that are oiled; documenting the numbers of animals killed and debilitated, now and in the future; documenting the cause(s) of death through proper necropsies and collection, preservation, and examination of specimen materials; collecting and archiving data and information in such ways as to maximize their value in future spill prevention and spill response efforts; and evaluation of containment, clean-up, and mitigation measures to effect improved responses in the future.

55

Intecol

International Association for Ecology
Association Internationale d'Ecologie
Internationale Vereinigung für Ökologie
Asociación Internacional de Ecología

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The Trustee Council
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Juneau, AK 99802

13 X 89

Dear Sirs:

I have read with interest *The State Federal Natural Resource Damage Assessment Plan for the Exxon Valdez Oil Spill August 1989.* As a seabird biologist, and as Chairman of the Seabird Specialist Group oflUCN/ICBP, I have a number of comments about the draft that I hope merit consideration and may reduce the likelihood of litigation against the Trusteees or of subpeonas by Senate subcommittees in the future.

My primary concerns is the time frame under which the Trustees apparently intend to act. Studies will conclude on 28 February 1990 (page 26); comments on this draft are due 30 October, having been extended 30 days from the original date. If studies are implemented immediately after the closing date of the comment period, this leaves four months. I note that this happens to be the Alaskan winter during which salmon do not spawn, seabirds do not nest, and shorebirds have mostly migrated out of the area. It is impossible in such a short time and under severe winter conditions to study these and most other subjects.

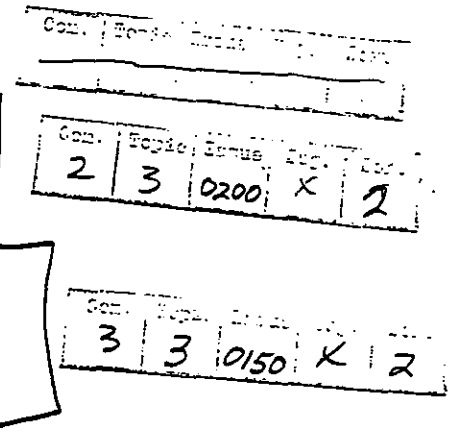
Com.	Topic	Issue	Sug.	Sort
1	4	0201		2

Although it is nowhere stated, I assume that some, but not necessarily all, of the studies have already begun and may have run during one breeding season. Given the presence of clean-up crews and containment efforts, conditions during the past season will hardly have been normal. Also it will only be after several years that we can assess survival of salmon or seabirds from last year's breeding efforts. Year to year variability in populations, reproduction and growth parameters make it extremely imprudent and scientifically foolhardy to base assessments on a single year.

There is a clear and present need for studies to continue for several years to assess the true impact of the *Exxon Valdez* accident. This is fair to both Exxon and the United States government. If the Trustees restrict operations to a four month winter period or even to the year following the spill on 24 March 1989, their data on damage will represent minima and there will be a need to extrapolate, based on very wide confidence limits, as to the maximum damage that occurred. Such extrapolation will no doubt be sought through the courts. This will cost taxpayers millions of dollars in legal fees on the government and NGO sides and cost consumers millions more in legal fees on the Exxon side. It also may result in the judiciary, rather than the Trustees, setting the final damage figures, thus negating the need for the Trustees. This in turn will prompt questions in Congress as to the prudent use of funds by the agencies involved.

I would urge therefore that the Trustees establish long-term programs with rigorously defined goals and with realistic termination dates to more accurately assess the damage. I would also urge that the Trustees involve the open scientific community in this work as much as possible. There are unfortunate rumors of gag rules for Alaskan scientists. By opening the evaluation, we can build a concensus about damage from the oil incident and avoid damage to the scientific reputation of the assessment, as may happen if outside biologists come in only at the end, as outside witnesses, whether for NGOS, Exxon or OMB, to evaluate the results.

Also I would urge that the Trustees consider novel definitions of restoration of habitats and populations. Restoration of habitats may have an extremely large cost, compared to the amount of restoration achieved. The Trustees may wish to consider biological equivalencies of restoration, such as acquiring of important seabird nesting or sea mammal roosting islands outside the affected area, to ensure populations of species that can not be restored through human means in the affected area.



I wish you every success in what is obviously an extremely difficult situation. I would be happy to be of further assistance or to identify scientists with expertise who could contribute to thorough evaluations.

Sincerely,

David Cameron Duffy PH.D.
Executive Officer, INTECOL and
Chairman, Seabird Specialist Group, IUCN/ICBP

cc: Senator W. Fowler

15.2.1

John W. Hillstrand
PO Box 674
Homer Alaska 99603

Trustee Council
PO Box 20792
Juneau, Alaska 99802

32

To whom it may concern;

I have fished up in these Alaskan waters for 32 years. I've seen alot of fluctuations in animal populations out on the water. There has been so much change go on in the past 49 years up here, it's hard to believe.

I've had my encounters with sealions biting my King Crab bouys, and lost over 30 700 pound pots from them. Now I use sealion bouys. Some kill them.

There is a cure to every problem, and an answer to every question. Most times more than one answer.

As an Alaskan resident, and citizen of the United States, my public comment on these Marine Mammal Studies is that you answer your questions in a more humane and less debilitating way on the Wildlife in Alaska. No study 6.

Com.	Topic	Issue	Sug.	Sort
1	3	1660	X	1

While you have access to this money, please put it to the best possible use. I wasn't able to fish this year. I have a great deal of money and my entire life invested in the fishing industry and I sicerely hope that our Fisheries are being protected, along with the natural inhabitants of the ocean.

You have a big responsibility on your heads and in your hands. It takes alot of forethought and even more Common Sense...

Steer clear of impacting animals any further and you'll gain respect of the people you work for. Show some innovative constructive people management. The creatures will do just fine. It's us they've got to worry about. Don't make them have to worry about you folks too.

Thank-you for your kind consideration.

Sincerely,

John W. Hillstrand

15.2.1

Payne

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MANOMET BIRD OBSERVATORY
MANOMET, MASSACHUSETTS 02345 (508) 224-6521

Trustee Council
P. O. Box 20792
Juneau, Alaska 99802

In reviewing the Public Review Draft of the Natural Resource Damage Assessment and Restoration Strategy Plan (hereafter the plan or document) for the EXXON VALDEZ oil spill forwarded by the Trustee Council, I found many obvious and rather glaring inconsistencies between the Restoration Plan and proposed studies found within the draft document. Among the proposed studies themselves, there was a noticeable absence of methods and statistics to demonstrate "conclusive" spill-related findings. This made it very difficult to evaluate any of the proposed studies under Part I of the plan except to say that, while the studies are certainly needed, not enough thought was put into them to merit review or funding based on that which is made available in the present draft document.

The following is a discussion of some of the problems I had with the document including statements regarding some of the general inconsistencies found between the Restoration Plan and the proposed studies; and the implementation and likelihood that these proposed studies will produce any "conclusive" results which could or could not be used to demonstrate an effect of the oil-spill. Also, I have included comments relative to other difficulties found while reading the document which hampered my evaluation.

RESTORATION STRATEGY-OVERVIEW

On page 23, the criteria required for an acceptable study were briefly outlined and exerpted as follows:

1. The expected magnitude of injury or loss in services will be detectable and quantifiable.

2. The study design ensures high probability that resulting data will be conclusive.

3. The study is conducted in the most efficient, cost-effective manner.

4. The study is ... coordinated with other studies for maximum effect.

The draft document, Part I, continually refers to the need of a statistically valid design for sampling coastal habitat injury. This should provide a basis for determining the extent of injury to the entire area affected by the oil spill. There is

little evidence outlined in the proposed studies (pages 112-175) which would indicate that this is nothing more than agency rhetoric. As I examined each proposed study, I never found a statistical plan outlined in any methods section. The authors continually refer to "standardized methods" or "established techniques" jargon without specifying the techniques. The most commonly outlined method was a comparison of oiled beach areas to unoiled beach areas (as controls) using a simplistic paired-test to measure differences between areas. To assume that the differences were the result of the oil-spill is statistically and biologically absurd. It is apparent that such a comparison will produce a significant difference between areas; however, these results will likely have nothing to do with the effect or amount of oiling but rather to the different biological characteristics within each area. Also, there will be differences among areas which were oiled. Such studies do not provide conclusive results, nor do they demonstrate (nor do they even suggest) cause and effect. One will not be able to make a statement as to the effect oil had on the variable being measured nor will you be able to provide any statement that oiling had no effect. Based on what we had to review, it is safe to state that the resulting data will be neither quantifiable nor conclusive. On only a few occasions was there any indication that enough thought was put into the statitistical methods used in the proposed studies to produce that level of veritable results.

2	5	0103	2

Furthermore, the Restoration Plan (p.27) stated that it would focus on the long-term recovery of the ecosystem yet most studies were designed for early detection and determination of injury with a termination date of February 28, 1990. The Plan states that studies should determine and quantify the ... rate of recovery (page 29). It is sophomoric to think that this can be accomplished in such a time frame . Also, restoration alternatives focused on returning the damaged elements to "pre-spill" determination. With the exception of relatively clean, oil-free beaches, pre-spill levels of naturally occurring organisms are unknown. The numbers of seabirds that winter in Prince William Sound (PWS) and the production rates of seabirds, otters or other pinnipeds that were affected by the spill are only a few examples of those pre-spill levels that are unknown. It is unrealistic to focus on a pre-determined point that was not pre-determined.

3	4	0201	0

SPECIFIC COMPLAINTS

The Marine Mammal Studies #1 and #2 are based on the ability to identify individual whales. This on its own seems adequate. The inadequacy lies in the agency's (NOAA/NMFS) hypothesis that the animals which have used PWS in the past but did not return, or animals that left PWS, might be interpreted as a result of the spill. Again, the resulting data will be inconclusive. This presence/absence evaluation and the interpretation of this evaluation is a completely inappropriate procedure to determine whether a demonstrated shift in whale distribution was spill related or the result of a more natural phenomenon, i.e. prey re-distribution. These whale-focused studies should be conducted concurrently with other proposed studies, i.e. Fish/Shellfish Studies

4	3	1610	2

Numbers 11 and 17, to determine if a shift in prey might not have resulted in any change in the distribution of the humpback whales of PWS. In Glacier Bay, noise and disturbance from cruise ships were implicated in the decline of humpbacks in that area during the late 1970s. It has been since demonstrated that local increases in prey abundance elsewhere were a significant (if not the only) factor causing this shift. The cetacean studies outlined in the draft document should be more integrated with other investigations especially those which can attribute shifts in prey to whale movements. If not, then once again the study will produce less than conclusive information.

The study regarding the killer whale population (Marine Mammal Studie #2) is also filled with similar problems. The entire analyses and methods are based on a presence/absence of individuals and comparing that to pre-spill pod composition. Studies are recommended which would document the lethal impact of the spill but no methods are stated. Since the sublethal impacts of oil could only be demonstrated on captive animals, it is unlikely that the sublethal impacts of oil on killer whales will be possible within the framework of this study.

Com.	Topic	Issue	Sug.	Sort
5	3	1620		1

Finally, there are many studies which are being conducted by different agencies that could be combined, i.e. humpback studies (p. 113) and herring studies (p. 75). Because the level of interagency cooperative research is not there, it is unlikely that these studies are as cost-effective as they could be.

Com.	Topic	Issue	Sug.	Sort
6	3	0100		2

These are just a few of the obvious problems within my own area of interest. However, the entire document is full of glaring inconsistencies and holes. It seems that the plan was put together in a haphazard manner. While the intentions were good, the resulting data from such poorly-constructed studies will do little to evaluate the impact of the oil spill.

Com.	Topic	Issue	Sug.	Sort
7	5	0100		2

Sincerely,

P. Michael Payne
Marine Mammal and Seabird Studies

15.2.1

Rott

Mrs. Nancy Rott
Box 1428
Homer Alaska
99603

18

Trustee Council
Juneau Alaska 99802

I am a fisherwomen up here in Alaska. I travel alot in Alaskan waters. I see beautiful rafts of sea otters, seals, sealions, and all the other lovely sea creatures from Sitka up to Norton Sound.

It makes me feel very sad that our wildlife are going to have to go thru any more trouble than they have already been through because of the destructive oil spill.

Com.	Topic	Issue	Sug.	Sort
1	2	1600		0

Please I hope that you will reconsider your Animal studies on Marine Mammals. Please don't use them to gain money my good God they have suffered so much.

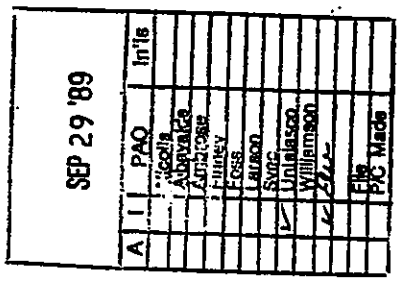
Can't you use samples from the dead ones you find on the beach and let everybody know that it is very important that they notify you when one is found. I know the natives kill the otters and seals, can't you take samples from them?

I have felt so helpless through this whole devistating oil spill I now feel helpless again to help these poor creatures who are at our mercy. Ibeg you people to please let these animals recuperate and get back to some semblence of their normal life. It's been so hard on us on land with our lives being turned upside down, We couldn't imagine how horible it must have been and might be for these creatures.

Please do a kinder form of reseach for these very special creatures of the sea. Compassion is something to be proud of and to honour.

Respectfully yours,

Nancy J. Rott



one of same

Mrs. Nancy Rott
Box 1428
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99603

33

Trustee Council
Juneau Alaska 99802

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Please do a kinder form of reseach for these very special creatures of the sea. Compassion is something to be proud of and to honour.

Respectfully yours,

Nancy J. Rott

Nancy J. Rott

15.2.1

not been undertaken as proposed. If correct, this is a serious problem; immediate commencement of data collection is imperative.

E. Bird Studies

After review of the sketchy study descriptions, the Environmental Groups are extremely concerned that all injuries to all bird species potentially affected by the Exxon Valdez spill will not be determined, and that the natural resource damage assessment will seriously undervalue the injury to birds caused by the spill.

1. Lack of Detail

As with all the proposed studies, the one- or two-page summary of each study is grossly insufficient for an understanding of what actions are actually contemplated, or to allow for meaningful analysis of the studies' effectiveness in determining short- and long-term injury to birds. Since few details are provided about sampling or analysis methodology, no conclusions can be reached about the statistical significance of data collected. Since the geographic scope of the studies is not described, we cannot evaluate whether injury to birds will be assessed for all areas potentially affected by the oil spill. Further, the "control areas" are not identified, making it impossible to determine whether they are in fact comparable to the oiled areas under study, and whether they will produce the most reliable comparative data. We have been denied access to data collected in 1989 or to information on the extent and quality of existing baseline data and the variability between years, making it difficult to review whether sampling protocols or injury determination methods are adequate to document injury.

2. Arbitrary February 1990 Deadline

The arbitrary February 1990 study termination date is incompatible with the objectives of many of the bird studies. The Environmental Groups are surprised to see that studies originally designed to extend from 3-5 years have all been reduced to 10-month projects. It is difficult to imagine how the Trustees can make this proposal with a straight face. Ten-month studies, ending only a few months before the next spring migration influx or reproduction season, cannot gather enough data to draw reliable conclusions on migratory patterns, population reduction or recovery, reproductive success, or survival rates, all purported objectives of many of the 14 bird studies. For example, we have learned that glaucous-winged gulls sustained high mortality among the subadult population. This mortality would have a big impact on breeding, but would not be discernable if the study ended after the 1989 breeding season. In addition, many of the beaches that birds use as staging areas are still heavily oiled, possibly resulting in additional short-term behavior changes during 1990. These natural resource injuries are all critical to a complete natural resource damage assessment, and will not be studied under the current approach.

The February 1990 termination date is also of great concern because of the potential incompleteness of the data actually collected in 1989. It is our understanding

that some of the projects were begun many months after the anticipated starting date, and data collection remains incomplete. Field studies in 1990 and beyond are therefore especially important, to develop adequate evidence that will demonstrate the connection between the oil spill and the long-term injuries.

3. Limited Definition of Injury to Birds

The nature of the injuries to birds addressed in the draft assessment plan is far too limited, and does not even follow the provisions of 43 C.F.R. 11.62(f)(1), referenced in the draft plan as the guideline for injury determination for birds. The bird studies focus almost exclusively on lethal impacts. Carcass counts (death) are included for virtually all species to be studied. Reproductive effects are included for only selected species (e.g., bald eagles and peregrine falcons), possibly selected because of their emotional appeal to humans. Studies that document the efficiency of the carcass recovery efforts – which likely are far less than 10% – should be a high priority. Apparently not included in the bird studies are disease, behavioral abnormalities, cancer, genetic mutations, other physiological malfunctions, or physical deformations. All injuries to birds, including those listed in 43 C.F.R. 11.62(f)(1) should be studied and included in future restoration plans.

The Environmental Groups are encouraged that the acceptance criteria found in the federal regulations are not mentioned in the draft assessment plan. Again, we urge the Trustees not to tie their hands with these overly rigid, often impossible to comply with, scientifically unfounded, acceptance criteria. We suggest that the Trustees use the traditional tort law causation standard. See, Restatement 2d of Torts, §431 (1965) (showing that it is more likely than not that the defendant's "conduct is a substantial factor in bringing about the harm").

4. Lack of Coordination Between Bird Injury Assessment Studies, Economic Value Studies and Restoration Planning

Each of the bird studies is described as an input into one or more of the three contingent valuation economic studies; namely, Economic Studies Nos. 5-7 measuring recreational, subsistence and intrinsic values. It is not clear, however, how the economic studies will consider the injury to birds documented in a study using an indicator species. The economic value must be calculated for each bird species injured, as extrapolated from the indicator species data.

Economic value studies are not the only use that should be made of the study results documenting injury to birds. The study results are critical for development of the restoration plan, yet no coordination for that effort is discussed. Restoration plans must also address all bird species for which the indicator species study documented injury. The plan does not identify the larger group of species represented by the indicator species. Finally, these bird injury studies must be used as an input to calculate restoration costs, a statutorily-mandated measure of damages.

There are multiple restoration options for injuries to birds resulting from the Exxon Valdez spill. Restoration of populations in many oiled areas may not be successful because of introduced predators, such as the arctic fox. The Environmental Groups urge the Trustees to consider alternative restoration measures, such as enhancement of other populations of the same species in other areas, or protection of new habitat for the injured species.

We mention only a few possibilities of equivalent resources for the Trustees' consideration. The Trustees could obtain title or conservation easements to land that serves as overwintering or staging areas for injured species. They could purchase commercial development rights for critical habitat areas, and logging rights in the Chugach National Forest, (e.g., Chugach Corp. holdings on Montague Island). They could obtain conservation easements for large stands in MacLeod Harbor or Patton Bay that provide habitat for nesting marbled murrelets and tree-nesting ducks such as mergansers. Similar opportunities should be investigated in Southeast Alaska. The numerous private land holdings throughout Prince William Sound should be reviewed for their importance as wildlife habitat, and title purchased or conservation easements obtained to protect the habitat.

Another option is to buy back the oil and gas development leases in Bristol Bay. While these options are not "tit for tat" replacement of the Prince William Sound resource or restoration of the damage caused by the Exxon Valdez oil, they are measures that can serve to decrease the cumulative (even synergistic) impacts of past and future threats to the affected bird populations from human activities such as oil spills. They can therefore provide long-term benefit to the natural resources injured as a result of the Exxon Valdez spill.

5. Missing Studies

A number of important groups of birds have not been included in the planned studies. Hardest hit of all seabirds were the Barren Island murres. Except in general abundance and distribution surveys, murres have been excluded. In addition, the draft plan does not include studies on cormorants or loons, despite earlier plans to do so. Finally, soft-substrate shorebirds should be examined west of Prince William Sound. Impacts on these shorebirds and on their prey in soft substrates could be significant. Studies must be undertaken to estimate the impacts of the spill on these species, or the assessment will significantly undervalue the spill's impacts on birds.

Com.	Topic	Issue	Sug.	Sort
58	4	1950		2

6. Bird Study 1: Beached Bird Surveys

Objectives A and B should integrate data collected by Exxon capture boats to the extent they are determined to be reliable. This may be the intent, but it is not clear from the project description whether the study will rely solely on data collected by the USFWS and ADF&G.

Com.	Topic	Issue	Sug.	Sort
59	3	1810		2

Beach surveys were particularly intensive in 1989. How does the effort of 1989 compare with the effort of previous surveys conducted from 1977 to 1988? Is there

adequate information on the effort to draw accurate conclusions from post-spill survey data, as stated in Objective D?

A single-season of observations immediately after the spill will be inadequate to meet Objective E.

7. Bird Study 2: Migratory Bird Surveys

Com.	Topic	Issue	Sug.	Sort
60	3	1820		2

How soon after the spill were migratory bird surveys initiated? Timing is critical. Without more information on the surveys already completed, it is difficult to determine whether Objective A can be met adequately. How has the study integrated the impacts of oceanographic factors that may have affected seabird distribution and abundance in 1989? How good are the baseline data to be used in Objective B?

It will not be possible to determine recovery rates (Objective C) after a single breeding season. Moreover, such population impacts cannot be determined until the birds hatched in 1989 return to breed. As many species of seabirds have delayed reproduction, it will be some years before recovery rates can be assessed adequately. Has the study design taken into account the possibility that age of first breeding will be affected if a large proportion of adults died in 1989?

8. Bird Study 3: Seabird Colony Studies

Com.	Topic	Issue	Sug.	Sort
61	3	1830		2

A 1990 survey is essential to determine declines in seabird numbers (Objective A). Not only is it important to examine numbers of returning birds, but because 1989 was an aberrant breeding year, a second year is necessary. Is the only control the lack of oiling at a nesting colony? Aren't there other factors that must be taken into account to make certain that unoiled sites serve as adequate controls, such as beach profiles and colony size?

Objective B should be stressed and should be as creative as possible. Possible strategies for restoring populations should included habitat acquisition and protection, predator control, and minimizing the impacts on seabirds from fisheries. Restoration should not be limited to those colonies that were directly affected by the spill, but should be expanded to include restoration or protection of other colonies of the same species.

9. Bird Study 4: Bald Eagles

Com.	Topic	Issue	Sug.	Sort
62	3	1840		2

The decline or recovery of bald eagles cannot be measured after a single year. In addition, Objective A aims to determine a rate of change. Is there a known rate from historical data? If not, it will not be possible to determine how the oil spill affected that rate of population change.

Because of the lack of information about the progress of the study, it is difficult to judge whether additional years are necessary to achieve some of the other objectives. For example, was productivity measured in oiled and unoiled areas during 1989

(Objective B)? Were data from the Exxon Eagle Team integrated to the extent those data are determined to be reliable? To evaluate oil-related winter mortality, the study proposes to fit 60 eagles with transmitters. Was this done already? If not, what sorts of data will be used to measure winter survival? Are Exxon Eagle Team data valid and available for Objective F?

10. Bird Study 5: Peregrine Falcons

A 1990 survey will be required to complete this study. It is our understanding that there were no peregrines occupying breeding sites in Prince William Sound in 1989, which simply would preclude accomplishing Objectives B and C for that area.

Com.	Topic	Issue	Sug.	Sort
63	3	1850		1

11. Bird Study 6: Marbled Murrelets

As with other studies attempting to determine population declines, a 1990 survey (at least) of breeding colonies will be necessary to achieve Objective A. Are there good pre-spill data for all of the areas to be surveyed?

Com.	Topic	Issue	Sug.	Sort
64	4	1860		1

12. Bird Study 7: Fork-tailed Storm Petrels

We are concerned that the methods planned (but not stated in the proposal) to assess Objective B are not adequate. We understand that the field work was to consist of 2-3 weeks during the incubation period to find active nests, and 2-3 weeks late in the nestling period to check reproductive success. If this indeed is the schedule to be followed, the study may not yield important information on the percentage of eggs that failed to hatch and why. Although hatching success will be monitored and addled eggs will be collected, the study should also attempt to determine whether eggs failed to hatch because they were addled, infertile, abandoned, or contaminated. Likewise, the methods should include determining the proportion of nestlings that fail to fledge and why. The amount of fat reserves is apparently critical in determining whether a young bird leaves the nest or survives after fledging. The study should address whether the birds fail to fledge because they didn't have sufficient fat reserves, were abandoned, were oiled or fed contaminated food. Establishing the causal link between reproductive failure and oil pollution is key, to the extent it is possible.

The study should be continued beyond 1989 and should be expanded geographically to get better results on the persistence of crude oil in the environment. Because storm petrels breed from Prince William Sound to the Aleutians, continued and more widespread sampling of these colonies would enable better monitoring of the persistence of oil.

Com.	Topic	Issue	Sug.	Sort
65	3	1870		2

13. Bird Study 8: Black-legged Kittiwakes

1989 appears to have been a particularly poor year for kittiwake reproductive success. Special care must be taken to seek to document impacts that can be attributed to the oil spill. Will all 26 sites be monitored? If not, how will control sites be selected? Although Objective C will involve analyzing petroleum contamination of eggs,

Com.	Topic	Issue	Sug.	Sort
66	3	1880		2

the study should examine the percentage of eggs that failed to hatch and determine why. The proposal states that contaminated adults may not feed their chicks. Will the study assess the impacts on chicks from inadequate food supply as separate from contaminated food?

Com.	Topic	Issue	Sub.	Sort
67	3	1890		2

14. Bird Study 9: Pigeon Guillemots

Although guillemots can provide good data on local oil conditions in Prince William Sound, this study cannot claim to "represent puffins, auklets, and murres," as puffins and murres breed largely in other areas, and therefore this assumption could lead to a significant underestimation of impacts on other species.

It is unclear how colony areas will be "surveyed for degree of oiling," as guillemots are black and external oiling will be difficult to assess.

Com.	Topic	Issue	Sub.	Sort
68	3	1900		2

15. Bird Study 10: Glaucous-winged Gulls

Because of the distance of Egg Island from the major impacts of the spill, a study of this colony may not provide the most comprehensive data possible. Impacts from oiling are most likely to be seen among immature gulls, which tend to stray from the colony. Adults are more likely to remain in the vicinity of the colony. It is our understanding that a big loss in the subadult population has already been observed. This points to the need to continue this study, and others, beyond 1989. The impacts on the subadult population will not have appeared as an impact on reproductive success in 1989.

Com.	Topic	Issue	Sub.	Sort
69	3	1910		2

16. Bird Study 11: Sea Ducks

We understand that funding for this study was not released until quite recently. This is unfortunate because it may have precluded gathering of data on birds that Summer in the Sound and around Kodiak, when oil contamination would have been greatest. Nonetheless, it can provide valuable data because it is one of the few studies that focuses on over-wintering birds. The February deadline will have to be extended in order to complete contaminant analysis on samples taken this winter.

Com.	Topic	Issue	Sub.	Sort
70	3	1920		2

17. Bird Study 12: Rocky Intertidal Shorebirds

We understand that studies for shorebirds were not initiated until mid-June. This is too late to have provided certain information needed to assure fulfillment of many of the study's objectives, and therefore this study may significantly underestimate the spill's impacts on affected species. This study excludes surfbirds, which do not nest in the Bering Sea, from Objective G. Impacts on shorebirds from contaminated prey could be felt for years, and the study must continue beyond 1989.

18. **Bird Study 13: Passerines**

We understand that as of mid-September, the passerine study had not been initiated. Although some species are year-round residents, much information from the critical period following the spill has been lost. Although information on secondary contamination would be valuable, the samples may be of limited usefulness if they have not already been collected. This study must be salvaged by intensive monitoring and data collection next year, and by researching any available baseline data.

71	4	1930	2

19. **Bird Study 14: Effects of Exposure to Oil**

There is not enough information in this proposal to understand what "devise and implement laboratory or field experiments" means. However, the budget alone precludes significant experimental work on the effects of oil. The budget may not even be adequate to cover Objective A (literature review). Laboratory and field studies easily require in excess of $100,000 to be carried out properly. This budget is a gross underestimate for literature review and actual experimentation.

72	4	1940	2

F. **Technical Services**

The technical services studies are the linchpin of the entire natural resource damage assessment. The credibility and defensibility of the Exxon Valdez assessment will depend in large part on the extent of sampling and the validity of sample analyses. Many economic value studies, regardless how sophisticated and well-designed, could result in undervaluations if the input data (injury determinations) are inaccurate or inadequate. Likewise, the conclusions about injury to specific resources will only be as reliable as the data (e.g., tissue samples and necropsies) supporting it.

73	3	2000	2

The success of the technical services studies is a function of both number of samples analyzed and the level of timely analysis. The Environmental Groups are extremely concerned that the budgets proposed for Technical Services Studies 1 and 2 appear to be grossly inadequate to document the full extent of the injury to the Prince William Sound resources in a scientifically acceptable or legally supportable manner. Our concern is aggravated by recent Trustee actions limiting researchers to submission of ten tissue samples each for timely hydrocarbon analysis. Exxon has been actively collecting samples since the spill, and will undoubtedly continue to do so in an effort to demonstrate that injuries confirmed are not related to the Exxon Valdez oil spill. The Trustees risk failure in court if they have insufficient or incomplete evidence of injury and cannot tie the injuries to the oil spill.

The universe of potential samples to be taken and analyzed is enormous. Hundreds of miles of beaches have been oiled by the spill. Over 1000 square miles of seawater and sediments have been contaminated. It is estimated that over 34,000 bird, 1,000 sea otter and 12 whale carcasses have been found since the spill. Representative samples of just the existing storehouse would greatly exceed the limited technical services budgets provided. If, as the Environmental Groups have demanded, all studies continue into future years, greatly increased budgets should be provided to assure that

27.

Nancy J. Hillstrand
P.O.Box 674
Homer, Alaska 99603

Trustee Council
Box 20892
Juneau, Alaska 99702

Greetings,

I have to question whether studies in this Draft Natural Resource Damage Assessment Plan and restoration strategy for the Exxon Valdez oil spill are fully justified scientifically; and are consistent with the ultimate objective of restoration of the ecology of the affected areas.

Com.	Topic	Issue	Sug.	Sort
1	2	0100	X	0

Marine Mammals Study Number 6 will not" identify potential alternative methods and strategies for restoration of lost use". How do you restore replace or acquire the equivalent of the damaged resources namely the Sea Otter. Can we accurately state that this proposed Sea Otter research does not on its own cause injury and damage to very nearly the same number of Sea Otters as were found dead on the beaches from the oil spill? To release an animal back into the wild with four substantial bleeding wounds constitutes injury under any guise of justification put forth by this type of invasive research.

Com.	Topic	Issue	Sug.	Sort
2	2	1660	X	0

This proposed opportunistic study will be taking advantage of recuperating Sea Otters in obviously impacted areas with little regard for principals or consequences.

Boat and aircraft surveys for population estimates along with Pup ratio counts to measure productivity, and necropsies performed on carcasses found to determine cause of death are commendable. but to capture, drug, double tag take blood samples, milk samples, visceral fat biopsies, other tissue biopsies, inject live otters with subcutaneous transponder chips, and instrument these animals with transmitters does not take into consideration the moral duty and obligation of the Fish and Wildlife Service duty to protect the resource and maintain the health and stability of the marine ecosystem.

The money used in the damage assessment studies should be used wisely and appropriate methodologies should be chosen for the assessment. This money should be used to research containerized transport of oil of safe overland transport not wasting time and money harassing an already ailing creature. Lets get down to the bare bones of this matter and show some constructive intelligence.

Com.	Topic	Issue	Sug.	Sort
3	4	D102		2

This study needs definite inoependent review. This has been compiled without much foresthought and needs an overseer to assure bonafide scientific research.

With kind Regards,
Sincerely,

Nancy J. Hillstrand

Murkowski
Young
Stevens
Secy. Interior

1521

Alaskan Wild Animal Rehabilitation
Nancy J. Hillstrand
P.O.Box 674
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Mr. John Turner, Director U.S.F.W.S.
Washington D.C.

Greetings,

Pursuant to the Marine Mammal Protection Act of 1972, 16 U. S. C. 1361-1407 (as amended), and the promulgated regulations therein, I have to scrutinize the U.S. Fish and Wildlife research center's application for scientific research permit application, file No. PRT 740502.

In accord with 16 U. S. C. 1373, REGULATIONS ON TAKING OF MARINE MAMMALS, this states that" taking... will be consistent with the purposes and policies set forth in section 2 of this act." 16 U. S. C. 1361 (6) states "Marine Mammals have proven themselves to be resources of great international significance,esthetic and recreational as well as economic, and it is the sense of the congress that they should be protected and encouraged to the greatest extent feasible commensurate with sound policies of resource management and that the PRIMARY OBJECTIVE of their management should be to maintain the health and stability of the marine ecosystem."

The proposed Draft Natural Resource Damage Assessment Plan and Restoration Strategy for the Exxon Valdez oil spill describe " the studies that will be used to investigate the extent of natural resource injuries and of the corresponding damages to be sought from the potentially responsible parties, including the costs of restoring, replacing, or acquiring the equivalent of those injured resources." (see Federal Register Volume 54, No. 156). Can we accurately state that this proposed Sea Otter permit for scientific research does not on its own cause injury and damage to very nearly the same number of Sea Otters as were found dead on the beaches from the oil spill? To release an animal back into the wild with four substantial bleeding wounds constitutes injury under any guise of justification put forth by this permit.

The loss of the Sea Otters' lives cannot be restored or replaced. Any damages needing to be restored or replaced should pertain to the "health and stability of the marine ecosystem" (16 U. S. C. 1361 (6)), consequently the intertidal and nearshore subtidal habitats, and the benthic organisms used by Sea Otters as food. Research on the persistence of oil in these habitats will provide substantial evidence with regard to effects of the oil spill on the Sea Otter.

Com.	Topic	Issue	Sug.	Sort
4	4	1660		2

Regulation 16 U.S.C. 1374 Sec. 104. (c) (1) states that any person authorized to take or import a Marine Mammal for purposes of scientific research, public display , or enhancing the survival or recovery of a species or stock shall furnish to the secretary a report on ALL ACTIVITIES carried out by him pursuant to that authority. For example is there a clause to state that research be suspended if say two animals die during research procedures. All activities have not been reported . We need more specifics. This application does not show detail of design. There are many questions left unanswered. Due to the lack of coordination shown by the conduct of the Fish and Wildlife Service in the handling of Sea Otters while in captivity from the oil spill, I stress the importance of scrutinizing this permit.

Regulation 16 U. S. C. 1374 Sec. 104. (3) A permit may be issued for scientific research purposes only to an applicant which submits with its permit application information indicating that the taking is required to further a bona fide scientific purpose and does not involve unnecessary duplication of research. First, I question the validity of bona fide research and second, there are ongoing studies of telemetry going on right now, which constitutes duplication of research. These questions need to be addressed.

Com.	Topic	Issue	Sug.	Sort
5	2	1220	Y	0

Has the applicant demonstrated to the Secretary that the taking of these Marine Mammals under such a permit is consistent with this Act and the applicable regulations?

Regarding the 300 dependent pups, in the past there has been some trouble to these individuals due to the transmitters being implanted. We do not have enough information to prove that these transmitters are safe or have long term effects on this age group of individual. We must look further into this . Also it is unclear whether the mothers of the 300 dependent pups are part of the 650 to be captured or an additional 300 "incidental" captures which would take the number of Sea Otters impacted by this study up to 950 animals. Mothers and pups caught together can get so entangled as to cause strangulation, or crushing. Nets have had to be cut away from the entangled animals during capture.

Animals impacted by this study may be in bonded groups or pairs and the stress involved in breaking up bonded pairs is considerable as documented in records taken during captivity at the rehabilitation facilities This problem is not addressed in this application.

Six different drugs are used in this study. Animals have died from the effects of drugs while in captivity due to allergic reaction and human

error. both of which are possibilities in a study of this magnitude.

We are already having some of our equinoxial storms, otters are in a transition period of weaning and instructing pups for independence, entering into the mating season, and preparing for Winter. To impact and weaken them at this time with chase, capture, surgery and excessive handling will disrupt a crucial stage of their life stage history.

It is stated in the application that harrassment is" not applicable". This permit to conduct these activities is continual harrassment of these animals. tangle nets can be very dangerous, and there is the possibility of inadvertently entangling other species of animals; the blood drawing, extraction of teeth, surgeries , and punching of 1/4 inch holes in the flippers for tags is extremely invasive and painful to them. Do we know the impact of oil on open wounds? Fish and Wildlife has proved through the capture process that they will harrass individuals by chasing them continually over periods of over a month. This has been documented by Exxon employees who were working on the outer coast beaches and were outraged at the conduct of the Fish and Wildlife capture crews during the capture operations.

These procedures also cause stress which in turn may cause intestinal ulcers, inflamed mouth lesions , pneumonia, shock and exhausted adrenal glands as was documented through the capture rehabilitation program. Much of the additional excessive handling in the rehabilitation centers was an added impact on the health of the "rescued" animals. It is certain that a number of animals died in those centers from this additional impact under the guise of the oil impact, but in reality it was due to poor design of medical protocol which evolved at the whim of the Fish and Wildlife service and Veterinarian staff.

Due to these inconsistencies and lack of regard of these animals in captivity, I question the competence of a continuation of this type of activity . Without an unbiased professional Epidemiologist and Statistician to thoroughly analyze and scrutinize this program to assess the validity and design of this permit, I do not feel that this permit should be granted.

I feel that the magnitude and circumstances of this scientific research deserves a public hearing, and that the public comment period needs to be extended at least two weeks, if not until Sept 30th, to remain consistent with the public comment time frame of the proposed Draft Natural Resource Damage Assessment Plan's (Federal Register Volume 54, No. 156) I also request that the public hearings be held in the Alaskan towns

Com.	Topic	Issue	Sug.	Sort
6	6	1660		0

villages and cities affected by the Valdez oil Spill.

I appreciate your concern in this matter and I am looking forward to hearing from you soon.

Sincerely, With Kind Regards,

Nancy J. Hillstrand

Nancy J. Hillstrand , Director
Kachemak Otter Facility

12.6.1

25

Com.	Topic	Issue	Sub.	Sort
1	2	1660		0

Director , Fish and Wildlife Service
Mr. John Turner
Office of Management Authority
Box 3507
Arlington, VA. 22203-3507
Dear Sir,

Dominion, as described in Websters new world dictionary states: Rule or power to rule; sovereignty.

The Dominion of government has rule or power over the people, imagine if there had been a nuclear power plant explosion, and radiation had been emmitted over a 200 square mile area, and a certain faction of this government who had been designated the protectors of the people. This group of the government, decided to do experimentation over its people to test for the effects of the radiation over an 8 year period. The people had been badly burned by this and were highly impacted internally as well as externally. Their gardens and live stock were contaminated by radiation so even what they ate was toxic. During the first six months following this disaster thousands of people died, mothers and fathers watched their children die. Children were abandoned by their dead mothers and left to starve to death. Neighbours watched each other suffer and or die in great pain and suffering.

Imagine that the government decided to do experimentation over these people while they were still just barely recovering yet doing the best they could to regain some semblence of normalcy even though the disaster was still lurking close around them. Imagine if the government decided to inadvertantly capture women against their will while they were out grocery shopping and snatched the children off the playgrounds while their mothers were watching and sceaming to them in horror while the children cryed out to them for help. The mothers would be captured and restrained from protecting their young, one of the most powerful instincts known to man or beast, to watch the barbaric, painful treatment their offspring would go through. This government who had decided on its own to give the definition of dominion to mean unlimited non restrictive power to proceed with any type of behavior it deemed necessary. This government who was designated the protector and was thus named after the people. This government who were paid to be the guardian over the people. This certain faction of the government decided on a certain percentage of the population to be their victims. Half would be dependent children who needed to be clothed fed protected and taught the ways of

the world. The other half would be women in their prime reproductive years. A small percentage would be men. This research group forceably tied these innocent children down, drugged them, pulled their teeth, punched inch sized holes in between their toes, making some individuals bleed profusely.,and subcutaneously injected a pencil sized transponder under their skin. 100 of these children went through a surgical procedure whereby a transmitter the size of a quart sized milk carton was placed into the abdomen free floating with the other organs. The mothers screamed and struggled to reach out to rescue their children.They saw their babies blood being shed to satisfy only the gnawing hunger of greed and morbid curiosity of this certain faction of the government. Two ounces of fat was cut out of the childrens stomach before being sewn up through four layers of tissue. Over 100 ml of blood was drawn from each of 300 children, sometimes after continual holes had been poked into the legs and necks of these children and women in search of the veins. Eventually the victims would be released sometimes to die of complications sometimes to go through painful recovery unable to live normally because of this heavy block of equipment in their abdomens or the painful plastic tags which had been pushed through the wounds of their feet. The women of reproductive age who were instrumented with these milk carton sized transmitters would undergo extreme pain during intercourse because of this huge piece of equipment in their abdomens pushing against the other organs and as they got pregnant and the fetus grew the uterus would push up against this thing causing great discomfort and deformities of their child due to the foreign object. This wasnt the end of this horror for these victims. Again and again at any time during the next 8 years of their lives, they would be yanked out of society and undergo this extreme treatment of capture, bloodtaking fat chunks taken, and tooth pulling. The transmitters would never be removed. The government would receive money for this research the people would receive nothing but the pain, agony, stress, and the knowledge that they had not only been impacted by the explosion but by the continual surgery and scientific research which was to prove what the victims were quite aware of already. That they had been impacted by the explosion and it was quite detrimental in more ways then just the contamination caused by the nuclear explosion. They also learned how the word dominion had been portrayed and defined by a certain self interest group of the government to mean unlimited, non-restrictive power to proceed unquestioned with any type of activity this certain self interest group had deemed proper and necessary in the name of science.

This account is an analogy pertaining to the conduct of Fish and Wildlife sevice over our wildlife in Alaska. You may feel that this account is emotional or excessive and that is exactly the point. The conduct of the research group of the Fish and Wildlife service is totally unacceptable, and grossly excessive. It raises emotional, ethical, and philosophical questions which need to be brought forth before the American people. Without emotions and ethics on this earth the human being would be but a mere robot. What a sheer pity that being emotional is downgraded in our society. The justifications of this proposed program to captue and torment 650 Alaskan Sea Otters is vague and shows a total lack of regard for the true victims of the oil spill, the Alaskan Wildlife.

This program is just a ploy to steal exxon dollars or draw much needed U.S. treasury dollars for a useless study which we already know the answer to the questions searched for. Are the Otters impacted by the oil spill? Open your eyes Fish and Wildlife, the evidence has been daily portrayed in its horror. To continue with additional horror and impact is criminal and totally unacceptable.

Sincerely,

Frank J. Roth

The sizes of transmitters are in proportion to the size of a child compared to the size of a pup. The length of years is due to the length of time an otter lives compared to a human.

Frank Roth
Box 1428
Homer, Alaska
99603

15.2.1

23

The Trustee Council
P.O. Box20892
Juneau, Alaska 99702

To whom is involved in the damage assessment plan,

Trustee is defined as one to whom something in entrusted." Your agencies are entrusted to care for the health of and protect our wildlife populations. The studies pertaining to Marine Mammals do not do this. If you managed your budgets properly you would have enough money to perform your positions properly. we need enforcement out in the field, not this invasive surgery, and these studies to create jobs and bring in Exxon money into your coffers

Com.	Topic	Issue	Sug.	Sort
1	2	1600		1

THE ACTIVITIES PROCEEDING IN PRINCE WILLIAM SOUND MUST STOP IMMEDIATELY TO THE SEA OTTERSAND THE SEALS BEING KILLED, in the name of science.

Com.	Topic	Issue	Sug.	Sort
2	2	1660		1

The Fish and Wildlife Service and the Fish and Game Dept. have got to be under more control. These type of activities condoned by these agencies and done way out away from public view need an unbiased group who are not in cahoots with these opportunistic self interest agencies. I need a detailed justification of why you people feel justified in doing these kind of detrimental studies. If you make money on this information you may or may not gain, i request a detailed statement on where the money goes, and to whom, and proof that this money does indeed help out the impacted environment, not budget the researcher further torment of Marine Mammals or Terrestial animals. Or budget the beaurocrats sitting at their desks making biased decisions when they rarely get out into the disappearing wildernessto see first hand the effects of these decisions.

Com.	Topic	Issue	Sug.	Sort
3	6	0100		2

The scientific community has to open the club doors to concerned and rational people of the United States, and include the emotions of people to gain a well rounded balance of ideas as our Democracy proclaims

Use this damage assessment money more wisely to protect us against another oil spill. We are all well aware up here in Alaska that this impacted our Wildlife, and will continue to impact them as long as the oil is still in the water and on our beaches.

Demand a bill be passed now without further delay to assure us of this. Use the data you have already before you. I'm certain our court system isn"t so ignorant that it can't see the devistation.

If it is,we need a new court system

With kind Regards,

Al Helminski
BOX 4654
SOLDOTNA AK

cc: Emanual Lujan, Secy Interior
Senator Stevens
Senator Murkowski
Rep Don Young

15.C.1

24

Com.	Topic	Issue	Sug.	Sort
1	2	1660		0

Please Fwd

I find it appalling that a permit may be issued for otter research.

Capturing to save otters is acceptable but for research is unthinkable not in the best interest of Alaska & the natural habitat.

~~The practices used to capture & exploit sick otters are~~

Our treatment of the oiled otters was not humane in many instances.

It is unthinkable that the degradation continue for up to 650 healthy otters.

Sharon Roth
P.O. Box 2491
Homer AK
235-6308

15.2.1

RECEIVED
NOV 0 2 1992
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL
ADMINISTRATIVE RECORD

39

Millie Gray
P.O. Box 53
Talkeetna, Ak.
99676

[illegible] Council
Box [illegible]
[illegible] 99702

[illegible] Sirs:

[illegible] in Kodiak the fishing has been closed all [illegible] oil spill has been devastating to us. We hope and [illegible] to return to normal. Within the past two [illegible] are rolling up on our beaches, 2700 birds [illegible] Otters.

[illegible] hear that in addition to the oil spill [illegible] Wildlife and Fish the people designated to [illegible] for our Wildlife are going to Terrorize [illegible] animals for nothing more than to create jobs and [illegible] This is inexcusable. This must be stopped.

[illegible] United States citizen demand that this [illegible] Study number 6 pertaining to Sea Otters and the [illegible] the slaughtering of the 30 Seals be banned from [illegible] plan. These type of studies are grossly [illegible], proposed by the U.S. Fish and Wildlife [illegible], and the State Fish and Game Dept.

[illegible] Don't you dare even think of doing something like [illegible] This study shows stupidity and foolish waste of money [illegible] the impact to the ecosystem, not to [illegible] of Alaska any further.

[illegible] These cupidous agencies are looking for any excuse [illegible] monies at the expense of losing their [illegible] the supposed stewards of our Wildlife. We're [illegible] you, Fish and Wildlife, and Fish and Game, and [illegible] has only brought to the surface how shallow your [illegible]

[illegible] disgusted with you people. Protect our animals [illegible] regulations and DEMAND that bills be passed to [illegible] oil be spilled in our waters again... period. [illegible] honourably.

Sincerely,

Millie Gray

[illegible] George Bush
[illegible] Don Young
[illegible] Ted Stevens
[illegible] Frank Murkowski

Com.	Topic	Issue	Sug.	Sort
1	2	1660	X	0

15.2.1

38

Mr.& Mrs.Norman Park
P.O.Box 686 FRED
Kodiak, Alaska 99603

The Trustee Council
Box 20792
Juneau, Alaska 99802

Com.	Topic	Issue	Sug.	Sort
1	3	1660	X	1

Dear Sir:

I am writing pertaining to the Proposed Draft Damage assessment Plan, studies on Marine Mammals. The invasive capture and harassment of these studies must be omitted from these studies. Studies may commence observing populations doing aerial surveys, population densities, and a softer style of gaining knowledge about these animals.

We as United States citizens we demand that this degrading form of research be stopped immediately. Permit # PRT 740502 should be expeditiously revoked.

Your people should be out there surveying population densities with telescopes or binoculars, keeping completely clear of these creatures to assure that at least they can recuperate with some sort of dignity deserving of another being on this earth. Have some respect for these creatures. Add some compassion into your scientific formula it will gain you great credibility as the overseers of our wildlife.

Remember your organization works for the American people not for itself or for the approval of scientists or the scientific community. Any study should stand on its own merit. I don't believe this is bona fide research. Please stop it. Thank-you for your help.

Yours truly,

H N Park
L. K. Park

cc: President George Bush
Interior Secy Emanuel Lujan
Congressman Don Young
Senator Ted Stevens
Senator Frank Murkowski

RECEIVED
NOV 0 2 1992
EXXON VALDEZ OIL SPILL

22

Com.	Topic	Issue	Sug.	Sort
1	2	1660		0

Holle Jenkins
Red mountain otter center
Homer Alaska 99603

My first contact with sea otters came one morning very early in Valdez when I arrived at the "wash unit" at the community school at 6:00 am and was asked to monitor otters' condition in an intensive care unit. In a short while we all picked up animal carriers and moved the otters from that building to the junior high school gym. I then spent the day monitoring and feeding washed oiled otters in various stages of good and bad health. That night I helped clean oiled otters.

At Valdez over a period of time I watched otters die and otters get better. I knew otter caretakers who stayed with their patients through the opposing shift, taking cat naps to make sure these otters had the best chance of survival possible. Perhaps the brightest experience I had in Valdez was watching otters, their coats now returned to their normal state, taking their first baths in water which became a very dark brown quickly. Watching a partially rehabilitated otter in a spiral spin would melt the coldest heart.

Otter care has come a long way since plywood and heavy wire mesh cages, hastily

-ilt by contractors carpenters, but rough to say the least. I saw - otters with otters in the Jakolof Bay facility which houses many healthy, happy, peaceful otters. When, two days ago, I saw a recent transfer from the Seward facility squealing and flipping, loving the seaweed she dove through, which her pen mates had wrapped around them, I was sickened to know this beautiful, intelligent, affectionate (with other otters) non-violent, playful creature, who had survived against all odds from what I had heard early on in Valdez, was now being treated not as a creature returning eventually to freedom, but as part of an experiment. She had a sizeable radio transmitter instead of so much subcutaneous fat in her belly, and would have this forever. She was to be tracked, certainly, but why? and by whom? that is, could persons less friendly than scientists track her to cause her harm?

The story goes that otters must be tracked so as to know if they return to oiled areas. Why? Are they to be re-collected and taken elsewhere the set free to do it all over again. Otherwise pointless. Another story is that the information is to be used in future oil spills. Basically

to what end? Giving the experimenters the benefit of the doubt, what about the sea otters from the Valdez facility which were released with radio transmitter implants in July? Are these not a large enough sampling from the population of captured oiled otters to give an indication of what they are about? Or is the problem that otters, like human beings, are individuals. Some adapt to current surroundings. Some go where food (work in humans) is to be found. Some would do anything to return to their place of birth, and from anywhere.

Another reason for implants might be to see if these otters would be able to adapt and reproduce in the wild again. What is the difference between groups of otters mating and reproducing (which they are doing) in pens, with each other and with wild male "rogue" unoiled otters, and doing the same in a greater space - Only the food source is different - The otter has no control. The Jakolof Bay facility has a simulated wild environment. When an otter left recently, a pen having been left open possibly by people who drew blood from her and her pen mates earlier in the day, she wasn't shy about striking out on her own. Her pen-mates stayed put. Would it not have been sensible

for these five otters to have been released somewhere together so the independent one could help the others find food and survive? Or go their separate ways... Winter is near. Don't let the August sun fool you. Even vaccines can't halt the change in seasons. Even one of these strong animals which has been resilient enough to survive half hour washings and forty minute rinsings (after the trauma of becoming oiled and captured) who has been nursed back to health by people who do care, might find re-entry into the wild in fall or winter with a heavy cold object in his or her belly less than a bonus in her continued attempts at survival. What experiment? Can these conditions be likened to reality, to anything a sensible otter would bring about? Rather, is this not infliction of pain used as justification for the money spent by Exxon and the government on this rehabilitate project? Hasn't anyone been waiting to see a bill presented? Could there not be hidden, perhaps tax-related, certainly pro-oil exploration-related reasons for this experiment; this stressing out, possibly shortening long term, actually threatening short-term, the lives of these innocent refugees from the Valdez oil spill

Look at the scenario another way for a moment: members of your family, say children of two or three years, have been horribly injured in a major disaster such as a nuclear explosion at a power facility like three mile island. Say that children were given treatment which miraculously seemed to cure them but the scientists who invented the cure wanted to make sure of long term success or failure because they want to continue to use nuclear power and anticipate similar disasters elsewhere. How would you feel about the surgical implantation of radio transmitters in your children's bellies, in your own belly? People move. Scientists must have their data. You are grateful the government has paid the bills, has cured your children, but do they now own them? Would you also not want your children not returned to you, to their normal environment, as soon as possible to run and play in the summer sun, to recover from the months in a hospital room? Soon snow will fall. This isn't a fraction of the horror the sea otters have faced, may face.

I ask you to consider the consequences carefully for setting a precedent which m[ay] well extend one day to the greater population of the world. Sea otters are special beings.

Please, as you would wish to be set free, and I mean free, not subject to a lifetime of Big Brother's mechanized surveillance, set these fabulous Boys and others free!

Thank you...

[illegible signature]

COMMENTS ON MARINE MAMMALS STUDY NUMBER 7

(MM7) SEA OTTER REHABILITATION ($108,000)

This study attempts to assess the fate of sea otters oiled and rehabilitated as a result of the spill by monitoring their movement, behavior, and survival via radio transmitters.

Technical Comments

This study is not cost effective because of its serious overlap with Study MM6 and the invalid methods used to establish pathway.

Neither the objectives nor methods address the issue of possible effects of implanted transmitters on the survival and behavior of sea otters.

There is no explanation of where sea otters will be released (in previously oiled but cleaned areas; in areas where they were captured; in unoiled areas), nor is there any mention of how sea otters will be located (airplane surveys, boat surveys, etc.). The timing of the location efforts is too vague--"often enough to evaluate survival"--to be informative.

Regulatory Comments

The study deviates from the regulations, as described by Paragraphs H, I, and Y shown in Tables 3-4 of this document.

COMMENTS ON MARINE MAMMALS STUDY NUMBER 6

(MM6) INJURY TO SEA OTTERS ($763,000)

This study attempts to assess the injury from the oil spill to sea otters in Alaska by comparing numbers of live and dead sea otters in oiled and non-oiled areas, estimating populations, including decline, of live otters in the region and documenting presence/persistence of hydrocarbons/toxins in live and dead sea otters.

Technical Comments

The cost of this study ($763,000) does not seem reasonable, particularly considering the fact that no consideration is given to how to restore this resource to a level it would have been if the spill had not occurred. Much of the work proposed in this study is of a research nature, rather than NRDA related.

Insufficient information is provided to assess the adequacy of the methods for detecting and quantifying injury to sea otter populations. No information is provided whether sea otter populations are increasing or declining in the affected areas.

Statistical design is lacking in the study description. No information is provided on the number of sites (oiled and non-oiled), the number of samples collected, nor the number of replicates. No information is provided on the criteria for selecting non-oiled control areas.

Regulatory Comments

The study deviates from the regulations, as described by Paragraphs A, B, C, H, I, O, U, V, X, and Y shown in Tables 3-4 of this document.

more refined methods are undoubtedly possible, this concept of underrecovery is critical to a complete natural resource damage assessment.

12. Marine Mammal Study 7: Sea Otter

The Environmental Groups are pleased to see a study evaluating the effect of cleanup measures on wildlife, but the description of the study is so inadequate that it is difficult to understand exactly how it will be carried out. See, Comments of Defenders of Wildlife. More "rehabilitation" efforts on other creatures should be evaluated.

Com.	Topic	Issue	Sub.	Sort
55	3	1670		2

D. Terrestrial Mammals Studies

1. Lack of Detail

The terrestrial mammals studies provide no indication of sampling locations or methods, and do not describe the timing or frequency of sampling. It is therefore impossible to determine whether the study results will be statistically significant, or will support reliable or defensible conclusions of injury to natural resources.

Com.	Topic	Issue	Sub.	Sort
56	3	1700		2

2. Arbitrary February 1990 Deadline

The terrestrial mammal studies themselves reflect a multi-year sampling and analysis effort. Terrestrial Mammal Studies 2 and 4 seek to document the effects for bears of "subtle long-term population reductions as chronic effects of hydrocarbons stored in fats are expressed." Similarly, the mink reproduction experiment (Terrestrial Mammal Study 6) assumes over two years preparation (feeding mink with oil-contaminated food) before chronic effects will be studied.

A February 1990 termination of terrestrial mammal studies would significantly limit the data available to determine long-term injury. Since many mammals use tidal areas that were oiled this year during the spring, long-term behavior changes cannot be identified until at least one additional spring passes. Further, many of the mammals under study hibernate, and are no longer available for observation prior to February 1990. Effects on reproduction also will not be seen until they emerge from hibernation.

3. Limited Definition of Injury to Terrestrial Mammals

The proposed studies focus on terrestrial mammals that are of "value" to humans, presumably subsistence, recreational or intrinsic value. There are nevertheless many other mammals affected by the oil spill, for which no injury determination studies are provided. To fulfill their trust obligations, the Trustees must determine short- and long-term injury to all terrestrial *mammals*, from rodents, to Soricidae (shrews), to bats, to lagomorphs (e.g. hares). The assessment plan should specify how injury to all mammals potentially affected will be determined. See, Defenders of Wildlife comments.

10. Marine Mammal Study 5: Harbor Seal

Com.	Topic	Issue	Sug.	Sort
53	3	1650		2

This study seems to be designed to succeed. Much of the data will be collected by ADF&G, the organization that has the largest "before" data set.

How will effects of a documented population trend towards decline be separated from the effects of oil contamination? The Trustees should be careful of dismissing a reduction in numbers as the continuation of a trend, rather than as the result of petrochemical poisoning.

11. Marine Mammal Study 6: Sea Otter Injury

Com.	Topic	Issue	Sug.	Sort
54	3	1660		2

We recognize that long-term and chronic effects in marine mammal studies can be difficult, expensive and time-consuming to isolate, yet we believe that Objectives A-C are achievable. Objective B should be clearer. For example, what long-term effects will be determined?

The scope of this work is breathtaking. Can this many animals be tagged without significantly disturbing the remnant population? The Trustees should consider using minimum targets for tagging, rather than maximum (up to 100) numbers.

The Trustees should be careful of drawing incomplete or incorrect conclusions, based solely on where an otter was found for study. Many areas were emptied of sea otters directly after the spill through death and rescue efforts, but have now been repopulated with otters. Without knowing the returning otters' life history, the data they provide will not fully document the extent of injury to otters surviving the plume of the oil spill. The discussion of methods and analysis are too superficial to allow meaningful review.

How many sites will be studied? What type of surveys and equipment will be used? We assume that receivers with autologging capability will be used at unobserved sites, and that receivers will be aboard all boat and aircraft surveys. The Trustees should be careful that the study yields a large amount of useable data, rather than becoming a lesson in logistics.

There is one major problem that is not addressed. What percent of the sea otters that die from oil are ever recovered? The number of carcasses found in the freezer is merely a minimum body count, and a significant underestimate. The Trustees must devise a method of estimating the percentage recovery of sea otter carcasses. We describe one possible crude method. Some otter carcasses could be instrumented, tossed into the Sound, and observed to determine how many are ultimately found on a beach through existing routine search efforts. In addition, observers' (those who polished rocks and recovered sea otters) ability to locate otter bodies that have beached could be tested by placing some oiled carcasses on or near oiled and non-oiled beaches. similar studies are needed to determine the recovery rates for carcasses of other species, including other terrestrial and marine mammals and birds. From these crude experiments, one could probably measure a recovery of far less than 10-30%. While

interference through purchase of logging or other development rights. Finally, actions could be taken to control high-seas drift-net fisheries, thus providing long-term increases in certain marine mammal and other affected populations.

The Trustees also should be considering the development of management plans for marine mammals in Prince William Sound and contingency plans for future oil spills to avoid impacts on marine mammals; designation of sections of Prince William Sound and other areas as a sanctuary and elimination of all tanker traffic; and acquisition of habitat or development or harvesting rights for marine mammals or their prey, to assure protection.

5. Missing Studies

Com.	Topic	Issue	Sub.	
48	4	1680		2

As noted earlier, we recommend careful field studies be undertaken, if they have not already been initiated, to determine sub-lethal long-term and chronic effects on marine mammals. Such studies must be supported by adequate autopsies and histopathological and other analytical work.

Most of the more than 25 species of marine mammals found in and around Prince William Sound are not specifically described as being included in the plan's studies, and we are therefore deeply concerned that they will be overlooked by the Trustees. While we recognize that many of the small cetaceans are difficult to study, and little baseline data may be available, the Trustees must nevertheless attempt to determine injury to these species to the extent possible. In addition, all species must be included in restoration planning. The limited focus on only a subset of the potentially affected marine mammal species underscores the serious undervaluation that will result from the Exxon Valdez natural resource damage assessment.

6. Marine Mammal Study 1: Humpback Whale

Com.	Topic	Issue	Sub.	Cont
49	3	160		2

What proportion of the 40-50 animals appear in Prince William Sound in a given year? How many years of study were required to find the 40-50 animals? A decrease in the animals using the Sound in one year (found through an increase in effort) could easily and incorrectly be dismissed as yearly variation. Multi-year studies are needed.

Objective A is achievable as long as one remembers that all whales will not be counted or identified.

Objective B is unclear. The Trustees should consider putting more effort into the Sound and Kodiak area studies, which should reveal whale distribution on a much finer and more sensitive scale.

Objective C is the key to the damage assessment. Yet, the hypothesis and methods are not explained. How will this be done?

The emphasis on individual identification methods of animals is sound and has the highest chance of revealing subtle changes in distribution and abundance. The key

We also urge the Trustees to develop data to document injury resulting from both the oil spill cleanup efforts.

Again, the Environmental Groups are encouraged that the acceptance criteria found in the federal regulations (43 C.F.R. 11.62(f)(2)) are not mentioned in the draft assessment plan. As noted before, we urge the Trustees not to tie their hands with these overly rigid, often impossible to comply with, scientifically unfounded, acceptance criteria. We suggest that the Trustees use the traditional tort law causation standard. See, Restatement 2d of Torts, §431 (1965) (showing that it is more likely than not that the defendant's "conduct is a substantial factor in bringing about the harm").

4. Lack of Coordination Between Marine Mammal Injury Assessment Studies, Economic Valuation Studies and Restoration Planning

The draft assessment plan does not indicate how the seven marine mammal studies will be coordinated, how data relevant to multiple marine mammal species will be shared, or how these seven studies will be used to determine injury for the more than 25 species of marine mammals found in Prince William Sound. There also appears to be no coordination between the marine mammal studies and other proposed injury assessment studies for prey species, such as fish and shellfish. Data gathered and conclusions reached should be shared between the study teams, so that the marine mammal researchers can make injury determinations on the basis of relevant data not collected directly under the marine mammal studies.

The marine mammal studies are cited as inputs for those economic value studies using survey techniques (Economic Studies 5-7, recreation, subsistence and intrinsic values). While this is appropriate, the marine mammal studies should also be used to develop restoration plans, and to estimate the statutorily mandated measure of damages - restoration costs.

Restoration efforts for marine mammals must include restoration of their Prince William Sound habitat and prey species. This, in turn, requires restoration of the entire ecosystem to the extent possible, since many prey species (e.g., shellfish eaten by sea otters) themselves feed at the lower end of the food chain. If full restoration of Prince William Sound is determined to be infeasible, the Trustees must consider acquiring equivalent resources elsewhere.

The Environmental Groups suggest that options for equivalent resources include protection of other marine mammal habitats that are threatened by development or human activity. For example, the Cordell Bank area, near the Gulf of the Farallonnes Marine Sanctuary could itself be declared a sanctuary, thus protecting it from oil exploration and development. Similar actions could be taken to protect the offshore parklands of the Olympic National Park from oil and gas leasing. The Trustees could buy back the leases for Bristol Bay. Or marine mammal habitats in Southeast Alaska, such as Frederick Sound or the Alexander Archipelago, could be protected from human

2. Arbitrary February 1990 Deadline

It is absurd to think that complete data on lethal and sublethal impacts to marine mammals can be collected during ten months after the spill; as proposed, the studies will significantly underestimate impacts on marine mammals. The Environmental Groups understand that portions of the sea otter study are just getting under way, thus there may be less than 4 months of data by the February 1990 deadline. Other studies, such as whale necropsies, have apparently been discontinued for the Winter.

These are long-lived animals, many with birth and death rates smaller than for most other animals. Due to their mobility and small total populations, there is great difficulty in locating the affected marine mammal population. For these reasons, it has taken multiple years to develop baseline information, to the extent that it exists. One-year cetacean studies, for example, cannot be expected to give an accurate portrait of distribution or abundance, and therefore likely will underestimate the impacts of the spill. Cetacean studies conducted in the Farrollon Islands, and off Barrow, Alaska, have confirmed that humpback populations can vary significantly from year to year, so that one could readily conclude from a one year study that no impact or minimal impact had occurred, when in fact significant impacts may be documented by a multi-year investigation. Since marine mammal populations in the Sound vary year-to-year, and the effect of the oil spill on prey species is likely to be long-term, studies to determine the lethal and sublethal effects of the oil spill on marine mammals must continue beyond February 1990.

The research teams themselves (and the study descriptions) assume that the marine mammal projects will continue for at least 3-4 years. Several experts consulted by NWF opined that marine mammal studies should continue for at least 10-15 years, in order to document long-term injury from the Exxon Valdez oil spill.

3. Limited Definition of Injury to Marine Mammals

It is not clear that the studies will be investigating lethal and sublethal impacts for each marine mammal species. Although we understand that it is difficult to study impacts such as disease, cancer, genetic mutations, physiological malfunctions or physical deformations for living protected species, every effort should be made to gather relevant data wherever and whenever possible. Moreover, certain sublethal impacts are documented in certain marine mammals, including increased vulnerability to predation, interference with baleen functioning, interference with thermoregulation and metabolism, and aberrations in hematological parameters or enzyme activity (adrenal steroid exhaustion, for example), renal or other organ dysfunction, or even serious eye damage. NAS, Oil in the Ocean, at 424-30 (1985). It is our understanding that autopsies were not systematically performed during 1989 on dead marine mammals such as whales or sea lions. Unless remedied, this failure could seriously hamper the Trustees' ability to assess and recover for all potential injuries to marine mammals, including those listed in 43 C.F.R. §11.62(f)(1).

C. Marine Mammal Studies

Although the study descriptions are brief, the Environmental Groups are very concerned that the budgets provided for the marine mammal studies are inadequate to locate a significant number of affected marine mammals, or to provide the sampling and analysis necessary to properly determine the extent of injury. The small budgets, combined with the difficulties inherent in studying sublethal and long-term impacts in protected species, virtually assure that the marine mammal portion of the natural-resource damage assessment will fail to detect the full impact of the spill on marine mammals, and thus that marine mammal damage will be significantly undervalued.

1. Lack of Detail

As with the other studies, the marine mammal study descriptions are sadly lacking in detail on study methodologies, such as time and frequency of sampling and analysis, and timing and frequency of locating potentially affected animals. The Environmental Groups understand that each field researcher will be limited to submitting only 10 samples for timely analysis. This number is absurdly low for any study, but potentially fatal to attempts to detect the full extent of injuries in the case of marine mammals. Under this limitation, data can be submitted for few samples (e.g., liver, stomach content, muscle tissue) of three animals, or one sample from ten different animals. In either case, it is questionable whether the sample results will be sufficient to detect or fully document impacts of the spill on one of the richest marine mammal ecosystems on earth.

We cannot overemphasize the importance of having clear methods, lucid hypotheses and fixed end-points in the research plans for marine mammal studies, to avoid wasting money for statistically questionable and otherwise unreliable studies that are of an insufficient level of resolution to detect subtle or difficult to discern impacts, or that will be attacked as statistically insignificant. The study design must clearly anticipate how perturbations will be measured, and how an effect's relationship to the oil spill will be determined.

In addition, as the Trustees are undoubtedly aware, it is preferable to gather fresh samples for necropsy (e.g., viral and bacterial samples at the time of death) in order to isolate the cause of death. This requires steady monitoring of the coast to locate carcasses, perhaps as frequently as several times a week. The study descriptions are too vague to determine whether adequate surveys and sampling will be conducted to fully document the impact on marine mammal population, or to relate marine mammal injuries to the oil spill. The budgets are not broken into enough detail to determine whether sufficient airplane and boat surveying support has been provided. At a cost of approximately $300/hour for twin-engine aircraft (in great demand for virtually all the injury assessment studies), it is doubtful whether the budgets proposed will be adequate to locate marine mammals (especially cetaceans) in a timely manner to guarantee full necropsy results.