

RPWG
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1990 PILOT PROJECT PROPOSALS UNDER CONSIDERATION

<u>PROJECT</u>	<u>ESTIMATED 1990 BUDGET</u>
1. Dune rye grass restoration study	\$ 28,000 (ADNR)
2. Marbeled murrelet nesting habitat study	10,000 (ADF&G)
3. Restoration of <u>Fucus</u> communities	150,000 (EPA)
4. Reestablishment of critical intertidal species	75,000 (USFS)
5. Restoration of oil-impacted marshes	150,000 (EPA)
6. ID & prioritization of sensitive resources/habitats for acquisition	(50-100K)
7. Pinniped habitat protection study	125,000
8. Harlequin duck nesting habitat study	10,000 (ADF&G)
9. Artificial reef feasibility study	170,000
10. Development of 1991 pilot project proposals (cultural resources, recreation, population modeling, and monitoring of natural recovery)	25,000
11. Coordination of restoration/GIS data	(50 K)
12. Sea otter rehabilitation (histology)	80,000*
13. Forage fish identification study	(unavailable)*
14. Salmon & herring stock differentiation	(unavailable)*
15. Groundfish trawls/injury assessment	(unavailable)*
<u>TOTAL FUNDING NEED IDENTIFIED TO DATE:*</u>	<u>\$ 843,000 - 893,000*</u>

* Costs not included in total; project is important but should be reconsidered as a Damage Assessment study first.

May 1, 1990

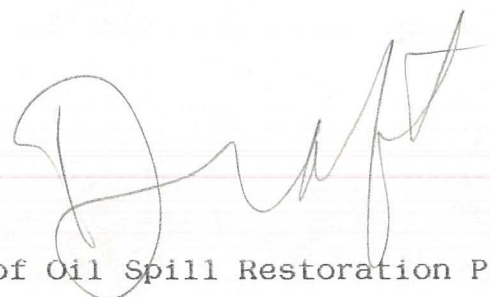
Summary of Contract Resources Committed to Date
for the Restoration Planning Project

	<u>Contract Funds (planned)</u>	<u>Dedicated Staff (planned)</u>
EPA Region 10:	\$ 200,000 (+ 250,000)	5.0 FTE
ADF&G:	25,000 (+ 250,000)	1.5 FTE
ADNR:	1,000	0.5 FTE
USFS:	-0- (150,000)	<0.5 FTE (1.0)
NOAA:	-0-	<0.5 FTE
ADEC:	-0-	<0.5 FTE

Restoration Briefing
May 2, 1990
10:30 AM

1. Restoration Planning Project Scope (NRDA Plan): (Al, 5 min)
2. Budget; proposed vs actual to date: (Al, 5 min)
 - Agency Contributions
3. Status of scoping activities: (summary of symposium, scoping meetings, technical workshop, lit. review report, and June 30 report: (Brian, 5 min)
4. Summary of legal issues meeting: (Al & Brian, 5 min)
5. Pilot project proposals: (Brian, 5 min)
 - Status of OW funding
 - ORD funding
6. Outlook for remainder of FY 1990 and OY 1990: (Brian, 5 min)
 - Coordination w/ cleanup. (Kirsten Ballard)
 - Personnel (Linda Comerici, Jackie Clark, & Nancy Menning in AK; OW staffing)
7. Scenarios for 1991: (Brian, 5 min)
 - Pilot project emphasis scenario
 - Public involvement emphasis scenario
 - Early settlement scenario
8. Wrap-up: (Al, 5 min)

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SUBJECT: ORD Support of Oil Spill Restoration Projects

FROM: Thomas Dunne
Acting Regional Administrator

TO: Eric Bretthauer
Assistant Administrator, Research and Development

The Restoration Planning Project for the Exxon-Valdez oil spill has gotten off to a good start. Several activities have been conducted during the initial scoping phase, including initiation of a comprehensive literature review on restoration techniques, a public symposium, a technical workshop, and local public scoping meetings. The support of the Office of Research and Development has been instrumental, not just in terms of EPA's involvement, but to the overall success of the entire interagency Restoration Planning Work Group. As Attachment 1 summarizes, EPA has provided the vast majority of the contract funds to date for the Restoration Planning Project; the majority of the EPA support has been provided by ORD. It is safe to say that the restoration planning effort simply would not have gotten off the ground without the assistance of ORD.

As a result of the scoping process, several potentially beneficial restoration approaches have been identified that deserve further attention and development. Attachment 2 is the set of descriptions for feasibility studies ("pilot projects") that the Restoration Planning Work Group feels are important to implement this summer. (The write-ups for these projects were developed largely by ORD scientists, based on their attendance at the technical workshop held in Anchorage in early April.) The Work Group's nominal budget for feasibility studies during 1990 is \$500,000. At this time, it is my expectation that EPA (through the Office of Water) and the State of Alaska will each provide half of this amount.

You will note, however, that the projects currently proposed total more than the available budget for this year. At the same time, two of the proposed projects - Restoration of Fucus Communities and Restoration of Oil-Impacted Marshes - seem to fall particularly well within EPA's mission and expertise. Independent of whether Headquarters ultimately decides to remain actively involved in restoration planning for the Exxon-Valdez oil spill beyond FY 90, the knowledge gained in these projects should have applicability for future spills, and in environments other than that affected by the Exxon-Valdez oil spill.

For these reasons, it strikes me that these two projects may be of specific interest to ORD from a research perspective. Certainly, the knowledge gained from these projects would be of direct benefit to the restoration planning effort. Should you decide to undertake these projects you could count on strong support from the Region and particularly from the Anchorage based Restoration Team headed by Brian Ross. In order for the projects to be most beneficial they should begin this year while the effects of the spill remain as obvious as possible so that the effectiveness of the technique(s) can be most accurately measured. However, I am concerned that they will not receive adequate attention this year without ORD's involvement.

The Fucus and marsh restoration proposals are each presented as two-year projects. The estimated budget for the first year for each is \$150,000. (The second year budget for the Fucus study is somewhat less.) Thus, a total of \$300,000 is necessary to initiate both studies. However, I am told that the US Forest Service is also interested in the Fucus study, and that they are in a position to cooperatively fund a portion of the work. Therefore, with half the Fucus study funding needs met, the total remaining need for the first year for the two studies would be \$225,000.

Please let me know whether you think that these projects would be of interest to ORD to pursue. Since field season is upon us, I would appreciate your thoughts as soon as possible. Please do not hesitate to call me to discuss this matter. If there are any technical questions about these proposals, Hal Kibby (at your Corvallis lab) and Brian Ross have been working closely together and can provide necessary information.

Attachments

KWG
over
for concen.
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Feasib. Studies (written up already)

	EST. COST, 04/1990	
✓ Otters	1990 7% VOTES III 80 K	90 WANT
✓ Rye Grass	IIII 28 K	28 10 150 75 150 (50-100) 10 25 [?]
✓ Marbled Murrelets	IIII 10 K	448 (498-548 (+GIS) 4 x 1 +2 [57 A
✓ Focus	IIII 150 K	
✓ Critical Intertidal Spp (limpets)	IIII 75 K	
✓ Marshes	IIII 150 K	
✓ Artificial Reefs	IIII 170 K	
Fish Studies #1 & 2	<Pen, salmon stock id.>	
?	Forage fish available	
✓ Aquis. of Sensitive Hab's (Prioritizat. for Aquis)	IIII	
✓ Sea Lion / Harbor seal hab. protection	IIII	
✓ Harlequin Duck	IIII	
Not written up -		
- \$ for GIS products / coordination	II??	
- Devel't of feas. studies ^{additional}	II??	

90
LIST

80
28
10
150
75
150
(125)
10
25

[50-100]
W/O OTTERS
648
(823)
[823-923]
W/O OTTERS =
618
(743)
[743-843]

W/O
IIII

No-Best
Ref. under
deq. Habitat.

10 K
628 K
EST'D
W/O
PROF'S OR GIS
- ? -
25 K

Pyle Grass

Marbled Murrelets

Fucus

Critical Intertidal Species

Marshes

Land Status/uses in relation to Damaged WR's
(ACB)

Harlequin Duck

Devel't of add'l Feas. Study Proposals

- recreation, cultural pre-feas,
- (forage av.) modeling, (monitoring?)

28k State (DNR)

10k State (F+G)

150k Fed (EPA-FS)

75k Fed (FS)

150k Fed (EPA)

(50-100k EST) UNFUNDED

10k State (F+G)

25k UNFUNDED

448k (+ Land Status

= 498-548k)

EST 25k?
PLUS GIS WORK, IF ANY
550-600

LIST:

Add. - Artificial Reefs

- Fresh Forage

- Stock ID (Salmon)

TO be written up

= 550-600

+ 170

720-770

Pilot Project 1990 -- Bird Studies

TITLE: Marbled Murrelet Breeding Habitat Identification

OBJECTIVES: Determine breeding habitat requirements for marbled murrelets in the Prince William Sound area, specifically to determine if they nest in trees and, if so, whether they are dependent upon old-growth forest habitat or can utilize second growth timber.

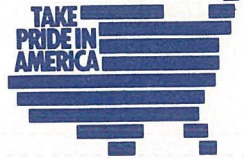
BACKGROUND: Marbled murrelets are noncolonial seabirds that breed along the west coast from Northern California to Alaska. In the lower latitudes, the birds are known to nest in trees and have a strong preference for hold-growth habitat (i.e., large trees with an open understory). However, in Alaska, it is not known wether these birds have the same requirements for nesting habitat or if they may utilize other resources such as smaller timber or ground nesting areas. The numbers of marvelled murrelets has been decreasing in the Sound since the early 1970s with only 40% of the numbers found in 1989 as were present in 1972. These birds depend upon the fisheries resource in the Sound which probably was damaged by the 1989 oil spill, further contributing to the stress on the population and potentially accelerating the rate of decline. Preservation of breeding habitat would contribute to support of the population and maintenance of a viable population.

PROPOSAL: A study would be conducted in the summer of 1990 along the shores and islands of Prince William Sound to determine the breeding habitat of marvelled murrelets. Visual observation of birds would be made and location of nests would be attempted. Additionally, a small number of birds would be captured during foraging flights in the Sound and equipped with radio-tracking devices. These birds would be located by helicopter or fixed-winged aircraft to identify nesting sites. Ideally, at least 50 nest will be located to determine how many are in trees and which are in old-growth versus second growth timber areas.

This project has a high probability of success as experienced personnel are on-site (USFWS) that could mount such a study on short notice. Information gained from this study is necessary for long-term preservation of the Prince William Sound population by identifying critical terrestrial sites that need protection in the near future (i.e., restriction of logging activities). Additionally, the results from this small study may have ramifications on management decisions throughout the range of the marvelled murrelet. v



United States Department of the Interior



IN REPLY REFER TO:

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503

AFWRC

APR 27 1990

Mr. Brian Ross
Oil Spill Restoration Planning Work Group
437 E Street, Suite 301
Anchorage, Alaska 99501

Dear Mr. Ross:

The enclosed pilot restoration proposal on sea otters prepared by Dr. Haebler (Environmental Protection Agency) and Dr. Harris (Armed Forces Institute of Pathology) is submitted for funding. Both principal investigators are recognized experts and have committed considerable expertise and time at the sea otter rehabilitation centers since the early days of the spill. If funded, the proposed histopathology in combination with hematology, toxicology, and clinical treatment will provide a scientifically sound assessment of rehabilitation as a tool for restoring sea otter populations. Please contact Paul Gertler at 786-3579, if you have any questions.

Sincerely,

Walt Stiglitz

Regional Director

Enclosure

Copy to: Sanford Rabinowitch
National Park Service

Subject: Research Proposal for Oil Spill Restoration Pilot Project 1990

Title: Rehabilitation: A tool for restoring sea otter populations?

Objective: To determine the efficacy of sea otter medical treatment and rehabilitation as a viable method for the restoration of the sea otter population following exposure to crude oil.

Rationale: Following the Exxon Valdez oil spill, a massive effort was undertaken to capture, clean, and medically treat sea otters exposed to crude oil. Of the 329 sea otters brought into rehabilitation centers in Valdez and Seward, 119 died in captivity, 37 were sent to aquaria, and 173 were released into the natural environment August 1989. Forty-five of the animals were radio-tagged and followed after release. Of these 24% have died and an additional 24% are currently missing. Exxon alone spent 18 million dollars to rehabilitate affected otters. The effectiveness of current capture and rehabilitation methodologies to preserve and restore sea otter populations exposed to crude oil needs to be re-examined.

Animals that died in captivity can provide crucial information regarding mechanisms of toxicity and pathological processes associated with exposure to crude oil, capture and rehabilitation. Analysis of data from these animals will provide information critical to assessing and modifying current capture, handling, and rehabilitation techniques for preserving and restoring sea otter populations exposed to crude oil.

Approach: In the 6 months following the Exxon Valdez oil spill, pathologists from the Environmental Protection Agency (EPA) and the Armed Forces Institute of Pathology (AFIP) were on site and performed complete gross necropsies on all sea otters that died at rehabilitation centers. Histopathology of samples collected from these animals will be conducted and integrated with the clinical record, hematology, clinical chemistries, and chemical residue analyses. The results of this study will allow us to:

- assemble, integrate, and analyze the response activities;
- describe gross anatomical and histopathological lesions in sea otters that died at rehabilitation centers;
- identify the role of stressors associated with capture/captivity as cause of mortality versus chemically induced mortality;
- develop a model to describe toxic effects and pathological processes that caused death in sea otters exposed to crude oil;
- test whether the necropsy, histopathology, toxicology, and hematology results are statistically related to handling, clinical treatment, and oiling; and
- establish rehabilitation guidelines for restoration.

Resources Required:	FY 90: \$80K	FY 91: \$50K
Responsibility:	AFIP: Dr. R. Harris	EPA: Dr. R. Haebler

DRAFT

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Memorandum To: Stan Senner and Restoration Team

From: Kathy Kuletz, Migratory Bird Management, USFWS

Subject: Proposal for a pilot study towards restoration of a seabird

Proposal Title: Identifying the nesting habitat of the Marbled Murrelet (Brachyramphus marmoratus) in southcentral Alaska as a step in the Restoration Process

Justification

The Marbled murrelet population in Prince William Sound has declined 60%, from 104,000 in August of 1972 (Dwyer 1975) to 41,000 in August 1989 (Klosiewski, pers com.). The south Kenai Peninsula shows a similar percentage drop. While the reasons for this decline are unknown, the 1989 oil spill likely contributed to or aggravated environmental conditions leading to it. At the time of the Exxon Valdez Oil Spill, the murrelet population in the Sound was low, but for the spill area as a whole the proportion of dead marbled murrelets recovered was higher than the population at risk (Piatt et al. 1989).

Alaska harbors an estimated 95% of the total marbled murrelet population in U.S. waters (Mendenhall 1988), making the decline in Prince William Sound a potentially serious set-back for the species. Given the lack of information on the murrelet's basic biology, the best mitigation would be to protect murrelet nesting habitat. This could be accomplished via the Restoration process by purchasing timber rights to critical areas in southcentral Alaska.

The problem with protecting marbled murrelet nesting habitat, however, is the lack of documented evidence of tree nesting by murrelets or the types of trees they use in southcentral Alaska. Although there are numerous qualitative accounts of marbled murrelets using trees in southcentral Alaska, the three documented nests have been ground nests. Therefore, before timber acquisition is recommended or acted on, it will be necessary to 1) identify nesting habitat characteristics, 2) document the existence of tree nesting in this area and 3) determine the extent of tree-nesting vs ground nesting in southcentral Alaska.

Eventually it may be necessary to identify specific timber stands as marbled murrelet nesting sites. However, given the size and remoteness of the spill area, it would be advantageous to implement pilot studies in the 1990 field season, to test methodologies and improve the design of a full-scale effort. In Washington, Oregon and California, techniques have been developed to map and identify murrelet nesting habitat. These methods depend on an extensive road system, large numbers of volunteers and minimal logistical complications. Similar techniques need to be tested in and adapted for Alaskan conditions.

Study Site and Methods

During the 1990 field season, Migratory Bird Management, U.S.F.W.S. will have a camp on Naked Island in Prince William Sound to follow up on breeding studies of pigeon guillemots and at-sea censuses of marbled murrelets from the 1989 damage assessment studies. With extra support from Restoration funds, Naked Island could provide a base to conduct pilot studies to address the first two information needs mentioned above. A brief outline of methods and schedule follows:

1. Identifying marbled murrelet nesting habitat.

Murrelets visit their nests from May through August, but peak activity is in July. They can be heard and seen flying inland at dawn, and to a lesser extent, sunset. During the 90 min. activity period a stationary observer uses a tape recorder to record murrelet numbers, direction, height and behavior. Bird height (relative to canopy) and behavior is an indication of the observation site being a flight corridor to nesting sites further inland, or a nesting grove itself. Habitat features (distance to ocean and fresh water drainage, slope, aspect, elevation, vegetation layers, tree species and tree size) can be assessed on-site and analyzed from aerial photos. By establishing a sampling grid on Naked Island, it should be possible to test for correlations between habitat type and murrelet use, and to locate potential nesting groves in the process.

2. Locating tree nests by ground search technique.

Sites with high murrelet activity will be staked out for an intensive ground search to locate specific trees used by murrelets. This method was used successfully in 1989 (Naslund et al. 1990). The technique is based on known attributes of tree types and daily peak murrelet activity periods. Multiple observers are stationed around specific trees from dawn through the late morning chick feeding. In addition, mist-netting can be attempted in locations where murrelets are observed flying below tree-top. This could provide experience and information on capturing murrelets for future radio-tagging efforts.

Study site advantages

Naked Island is advantageous for this pilot study because 1) It will already be serving as a base camp, avoiding the costs and logistical arrangements of establishing a new site. 2) Murrelets have been censused at-sea around the island over four summers. The field camp supervisor, Kathy Kuletz, is familiar with the local marine and terrestrial conditions, and with the dawn detection technique. 3) Naked Island has a diversity of forest types, often interspersed with open meadows. This patchiness makes more timber groves accessible and increases detection efficacy. 4) There are no bears to hinder observers.

There are two aspects of the Naked Island site which are advantageous for the pilot study, but inappropriate for a definitive study of marbled murrelet nesting habitat : 1) There is no dry alpine tundra habitat. Thus, ground-nesting by marbled murrelets can not be studied. An important component of future nesting-habitat studies should be the relative use or preference for ground vs. tree nests where both habitats occur. 2) There are no Kittlitz's murrelets around Naked Island. This closely related species is a source of misidentification where the two species co-exist, as they do at locations throughout the spill zone. Usually, the two species are lumped into a Brachyramphus category. Since Kittlitz's nest on the ground, their nesting habitat may overlap with the marbled's. It will eventually be necessary to address this potential source of error, and identify the species' differences.

DRAFT

Estimated Budget

Salaries

GS-9/ 2 pay periods (analysis
and write-up) \$ 2800

Volunteer expenses 2000

Travel extra transport arrangements
for volunteer(s) 1200

Contract (Aerial photo analysis) 3000

Equipment misc. extra equipment & supplies 1000

Total \$ 10,000

Literature Cited

Dwyer, T.J., P. Isleib, D.A. Davenport, J.L. Haddock. 1975. Marine Bird Populations in Prince William Sound, Alaska. Unpubl. Rep., U.S. Fish and Wildlife Service. Anchorage, AK.

Mendenhall, V.M. 1988. Distribution, breeding records and conservation problems of the marbled murrelet in Alaska. Unpubl. Rep., USFWS, Anchorage, AK.

Piatt, J.F., C.J. Lensink, W. Butler and M. Kendziorek. 1989. Marine birds killed in the 'Exxon Valdez' oil spill: An interim report. Unpubl. report. U.S. Fish and Wildlife Research Center, Anchorage, AK.

Additional Notes and Recommendations

Regarding the disadvantages of the Naked Island site, a good alternative site for studying the nesting habitat of both species of murrelets would be Kachemak Bay. The bay has large populations of both species, with the Kittlitz's fairly restricted in distribution. A variety of habitats are accessible by road, well defined hiking trails or by easy boat access from the Alaska Maritime National Wildlife Refuge in Homer. A large pool of volunteers could be accessed and accommodated, which is important in the labor-intensive work of documenting murrelet presence in-land. A study incorporating the Kittlitz's murrelet would address two concerns: 1) It would improve the data on marbled murrelets. 2) It would address the criticisms of the public reviewers regarding the exclusion of the Kittlitz's murrelet in the 1989 damage assessment study. The Kittlitz's murrelet, which did experience mortality from the oil spill, is completely restricted to Alaska, is less abundant than the marbled murrelet, and has even less known about its life history.

Kathy Kuletz

4/27/90

PILOT
PROJECTS

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RESTORATION OF FUCUS COMMUNITIES:

PURPOSE:

To determine the feasibility of reestablishing fucus in damaged areas of Prince William Sound. To develop and demonstrate potential large scale seeding techniques.

To demonstrate the efficacy of seeding vs transplanting of fucus.

RATIONALE:

Qualitative evidence indicates that fucus was damaged by both the oil itself and by the clean up effort.

There may be substantial delay in natural recovery of areas where populations were reduced over large (100 to 1000 meters of shore line) areas because dispersal of seeds is limited (< 1 meter in most circumstances) Drift plants may increase this distance but importance of this mode is unknown.

This is an important perennial plant that is a critical structural component of the intertidal habitat in Prince William Sound and serves as an important spawning habitat for herring. Reestablishment of this species will increase the rate of recovery of other associated biotic communities.

The reproductive and life history of the plant is well known. Effective techniques for collection of seed are well established.

In southern parts of the range plants are fertile year round so the timing of the application of seeds may be relatively unimportant in the establishment of the plant. The specific life cycle of fucus in Prince William Sound is unknown, but it is expected that plants will be fertile for at least most of the spring and summer.

APPROACH:

Due to potential logistic problems associated with working in remote parts of Alaska three key biological properties of the species need to be determined. First, laboratory experiments will be conducted to determine embryo attachment strength vs time after release. Second since the seeds must remain in suspension the effects of agitation on seeds needs to be determined. Third, the laboratory experiments will be conducted to assure that embryos will remain viable in culture media for two weeks needs to be established.

It is anticipated that the clean up procedures utilized may affect the success of retoring fucus habitats. Field tests will be conducted of various "seeding" procedures in varying types of oil and clean up disturbance. The "seeding procedures to be tested are: 1) Dispersal of embryos; 2) dispersal of fertile

branches; 3) transplant of fertile adults. All three methods will be tested in one control and one habitat that was disturbed by oil and subsequently cleaned. Dispersal of embryos will then be tested in the following "habitats" 1) Heavily oiled/not cleaned; 2) moderate-light oil/not cleaned; 3) Bioremediated; 4) Heavy oiled/hot water high pressure cleaned; 5) Heavy oiled/cold water washing; 6) Not oiled no cleaning. The experimental design will be to use three replicates of each habitat type and four replicates of each procedure and four replicates of controls to measure natural settlement. In habitat 6 above artificial cleaning of the rocks will occur so that both a seeding treatment and a transplant experiment will be done.

The endpoints (variables) to be measured will be: a) visible recruits (counts); b) survivorship (counts); c) growth as a % of cover and d) associated fauna.

OUTPUTS:

Report on the feasibility of full scale restoration of Fucus communities in subarctic environments.

RESOURCES:

FY90 R&D	⁵⁰ 125K	FTE 1.0	S&E	15K (Travel)
FY91 R&D	60K	FTE 0.5	S&E	10K (Travel)

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5 April 1990

Pilot Project 1990 -- Coastal Habitats

TITLE: Reestablishment of critical intertidal species

OBJECTIVE: To demonstrate the feasibility of reestablishing key faunal elements needed to recover fully functional rocky intertidal communities in PWS and other affected locations.

BACKGROUND: Intertidal communities were probably the most heavily affected of coastal environments. Elimination of entire communities, either through oiling or cleanup activities, has been documented. Further, initial results suggest that certain key species that are likely to structure these intertidal communities were moderately to heavily affected. Natural restoration processes in these communities will be limited by recolonization rates of these key species, which in some cases are known to be quite low. Reestablishment of Fucus alone may therefore not be sufficient to ensure reestablishment of pre-spill conditions on ecologically meaningful time scales.

Before a restoration plan might be proposed, we must demonstrate the feasibility of enhancing the rate of recovery of the intertidal community by the reestablishment of key grazers and predators.

RESEARCH PLAN: We propose to compare rates of recovery of intertidal areas with and without key species and combinations of species. Based on the damage assessment information available and presented at the restoration workshop, we have identified limpets as important grazers in these systems. Predators such as Nucella and Leptasterius could be just as important in structuring these intertidal communities, although there is currently no information suggesting that these species were heavily impacted by the oil treatment.

Grazer, predator, and grazer predator exclusion and enhancement plots will be established on the following "habitats" 1) Heavily oiled/not cleaned; 2) moderate-light oil/not cleaned; 3) Bioremediated; 4) Heavy oiled/hot water high pressure cleaned; 5) Heavy oiled/cold water washing; 6) Not oiled. A key aspect of the study will be demonstrating the feasibility of enhancing colonization by key species.

The usefulness of these studies will be maximized if done in conjunction with the Fucus recolonization studies being separately proposed.

RESOURCES REQUIRED:

FY90: \$75K

FY91: \$60K

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5 April 1990

*Ties in w/ recolonization
study in Herring Bay (Coastal Hab. - on Barge)
(Barge moving in on 5-4)*

Pilot Project 1990 - Coastal Habitats

TITLE: RESTORATION OF OIL-IMPACTED MARSHES

PURPOSE:

Oil removal from marshes is a slow natural process because they are sedimentary, anaerobic habitats with minimal flushing. It is unlikely that current clean-up techniques will be efficient enough at oil removal (or even attempted) in marshes to allow clean-up without long term adverse impact on the plants comprising the habitat and the associated flora and fauna. This project will utilize several approaches to remove oil from impacted marshes while attempting to minimize the impact of the removal process. Without reduction of oil to soil concentrations less than some critical value, regrowth in the oiled area will not occur. Restoration will utilize natural regrowth and plant transplant techniques to introduce healthy plants back into the impacted marshes.

Performance criteria for evaluation of success will be assessments of oil removal efficiency over the course of the summer for several different treatment techniques. Additional measures of success will be quantifying the manner by which the removal techniques allow minimal impact on soil compaction; minimum residual traces from trenching, raking or foot paths. Once oil has been removed, proven transplant techniques will be evaluated by percent viable plantings and growth (biomass) of the transplants.

RATIONALE:

Recovery of oil impacted marshes in Prince William Sound and the Gulf of Alaska may be slow as these marshes are small and uncommon, especially compared to those of major river deltas such as the Copper River. Because of their limited aerial coverage and their patchy distribution, opportunities for natural recolonization through seeding or propagule dispersal are extremely limited. These marshes are also important resources for the area, serving as an alternate food source for browsing mammals (especially in harsh winters), as refugia for small birds and migratory water fowl, etc. Restoration of a rare habitat that serves as an alternate food source or cover within the ecosystem should be a high priority.

Historical attempts for cleaning up spilled oil in marshes has shown that clean-up methods that disturb the soil or hydrology of the marsh will have long term effects equal to or more severe than direct oiling. Because of this, oil removal by EXXON has been discouraged to date. We expect to find impacted marshes with residual oil or with impacts by soil compaction or hydrological changes. This project will demonstrate the efficacy of oil removal by natural processes using techniques minimal impact on the marsh.

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In order to begin restoration, we must know the extent of oiled area, depth to which the site is oiled, concentrations of oil at these depths, and physical characteristics of water movement in the system.

Oil recovery in marshes and subsequent restoration techniques have utilized a variety of physical removal processes ranging from trenching, application of sorbent booms and pads throughout the marsh, and removal of contaminated soils with replacement with clean soils. Once oil removal attempts were completed, replanting was initiated. Success rates were unsatisfactory for sites where oil removal was not successful, where the process of removal altered soil characteristics or hydrology of the site, or where replaced soils did not match the physicochemical characteristics of the original marsh sediment. Without oil removal, plant growth and long term survival is not insured.

Transplanting efforts have been successful when proper site preparation has occurred. This experience has led to a state-of-the-art wisdom that recovery and restoration approaches can not use heavy equipment, work crews who trample and march through the area, or collection methods that leave altered landscape features.

This project will demonstrate the feasibility of using oil degradation techniques, applied in a minimally obtrusive nature, to restore oiled soils and transplanting techniques to provide viable propagules. The project will incorporate a test design that will allow comparisons of the relative rates of oil removal by several techniques and a determination of plant growth rates following transplant.

STUDY APPROACHES:

The project should be implemented in a large marsh, preferably where a large portion of the marsh was not impacted, so it could be used as a on-site reference (control). Oil removal techniques will be selected for testing based on some likelihood that they will be successful. Techniques to be considered are: 1) periodically, gently rake surface soils to bring oil to the surface, to disperse the oil more evenly throughout the surface sediments and to ensure aeration of surface soils; 2) to install a network of aeration pipes, buried in the oiled surface sediments of the purpose of constantly supplying air to the soil (under gentle pressure) in a manner similar to a drip irrigation system; 3) installation of a network of trenches to drain oiled soils or to supply air-saturated water on a periodic basis to infuse dissolved oxygen into the soils; 4) augmenting the aeration techniques with fertilizer to enhance the growth and metabolic rate of oil-degrading, aerobic bacteria and 5) and initial transplanting prior to application of removal techniques. Once we have evidence that oil concentrations in the

test plots have been reduced to acceptable levels, transplanting marsh plants will begin.

Test plots for each treatment could be on a 10M x 10M scale, should be triplicates within the marsh, and should be assigned randomly to available test plots. Proposed treatments are:

Reference (Control)
Rake
Aerate
Trench and flush
Initial transplants

Reference + nutrients (Control)
Rake + nutrients
Aerate + nutrients
Trench and flush + nutrients
Initial transplants + nutrients

If oil reduction techniques are successful, marsh vegetation will be planted in triplicate on randomly selected 2M x 2M plots within each of the above treatments and plant biomass determined at the end of growing season. Sites will be visited twice in the second year; once at the beginning of the growing season to determine if viable plants still exist and at the end of the growing season to assess relative plant biomass production.

Parameters to be measured during the demonstration project are:

Physical Site Characteristics

- Marsh soil descriptions
- Depth to peat (4 ang)

Chemical Parameters

- Hydrocarbons (according to standard analytical protocols used during the EPA Bioremediation Study)
- Nutrient Series
 - Nitrogen
 - Phosphorus
- Plant residues (oil)
- Water quality parameters
 - DO/temperature/conductivity/REDOX

Biological Parameters

- Microbiological assessment of oil degraders
- Marsh plant biomass
- Plant productivity - fluorescence
- Growth (photographic documentation)

measurement

RESOURCES REQUIRED:

Time period - two years minimum

Personnel - 1 - 2 man years

Resources - \$150K / yr

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5 April 1990

*Pink Salmon Stock ID
+ Herring Stock ID*

The extent of damage resulting from the oil spill and attendant operations is not well documented for several important species of commercial fishes. It is likely that the greatest impact of the damage will be seen in the year-classes produced during the year of the spill and the next several years. One way to limit further population depletion in these stocks is to limit any further controllable mortality, e.g. by halting all commercial fishing upon these stocks. However, because of the uncertainty of the extent of damage and because of the value of the commercial fishery and the human cost of season closures, an acceptable alternative might be to allow fishing but closely monitor the take so as to minimize the harvest of potentially oil-impacted stocks.

In the case of pink salmon, this could be accomplished by targeting fishing pressure towards hatchery fish and away from wild stocks from oil-impacted waters. Because these stocks tend to mix in the ocean, one method of targeting fishing is to concentrate on terminal fisheries (i.e. near the hatcheries at the time of return). There is still some mixing of stocks at this time, but the extent is not known. One project that is proposed is to expedite the identification of wild and hatchery stocks in this fishery. In the 1990 harvest, this would be expedited by rapid recovery and identification of hatchery marked fish from which data the proportion of non-hatchery fish could be calculated and fishing stopped or shifted if too many non-hatchery fish were being taken. Another aspect would provide more detailed information for the 1991 season; adult fish in various fishing areas would be tagged and released so that tags recovered at hatcheries and in oil-impacted spawning/rearing waters would provide detailed stock distribution data. These data would also provide a bottom-line damage assessment regarding the adult salmon return from oiled, and non-oiled areas, both to the fishery and to the spawning grounds. An ancillary task would be to provide funds to speedily evaluate the promise of otolith marking of hatchery fish to provide a way of marking and identifying all hatchery produced fish, rather than needing to rely on marking programs with sub-sampling uncertainty. Finally, conducting detailed spawning ground escapement counts and tag recoveries would provide impact information (both oil and fishery) and provide tagging-recovery data to help minimize fishing mortality on oil-impacted stocks. All these tasks would allow fishing to continue while reducing the likelihood that the harvest might significantly slow the recovery of oil-impacted stocks.

A similar problem exists with the herring fishery of Prince William Sound and adjacent waters. It is possible to shift the herring fishery from the Sound to outside waters, but there are indications that some herring in outside waters may be juveniles of the Sound herring stocks. If that is the case then shifting the fishery to outside would still impact the Sound stock. If we can, by scale analysis, show that the outside stocks are indeed separate, then such fishery shifts for the next several years would protect the possibly impacted Sound herring stocks. ✓

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5 April 1990

Costs?

Pilot Project 1990 -- ~~Bird studies~~

TITLE: Forage Fish Availability

OBJECTIVES: Determine numbers and distribution of forage fish ~~for seabirds~~ in Prince William Sound, in particular herring, sandlance, and other noncommercial fish species.

BACKGROUND: Many of the colonial and noncolonial nesting seabirds as well as bald eagles are dependent upon near-shore ~~fisheries~~ ^{for example} for a food source. ^{seals/sea lions, & commercial fish spp. such as salmon} It is suspected that a decrease in these resources over the last 10 years may be significantly contributing to the gradual decline of the seabird populations. If the oil spill of 1989 also affected the numbers and/or distribution of these forage species, then continued and accelerated declines in the bird populations can be expected and ^{the success} restoration attempts such as replacement of breeding habitat would be severely impaired. Additionally, influence of commercial fisheries activity on seabird and eagle populations often are part of management decisions. For example, sandlance currently is not harvested commercially in the Sound although it is a market fish in other parts of the world. If ^{other species} this species of fish is determined to be a critical resource to the birds in Prince William Sound, especially in light of potential effects of the oil spill on other forage fishes, then opening of this species to commercial fishing should be delayed, if not prohibited. The redlegged kittiwake population at the Barren Islands is declining due to over fishing of pollack in the area.

PROPOSAL: Acoustic tracking of schools of herring, sandlance, and other fish in the Sound should be done in summer 1990. Distribution and numbers of fish species would be plotted using a GIS currently under development for the Sound. Known locations of oil already have been entered into this system. Additional overlays should include locations of nesting colonies of seabirds and known locations of bald eagle nests, ^{& critical habitat areas for fish (salmon & herring spawning areas) & mammals.}

This study is very cost-effective as it could be piggy-backed onto other on-going studies of commercial fisheries (e.g., herring schooling) and would provide data to an existing GIS. Information gained from the study would be used in determining future restoration activities, such as protection of fisheries, where within the Sound efforts should be focused for habitat preservation (e.g., reduction in logging activities or other human disturbances). Additionally, sea mammals such as seals also utilize the same fisheries resource. Therefore, the information gained from this project would be applicable to a wide variety of species.

Costs?

Pilot project 1990 -- ~~Bird studies~~

TITLE: Prioritization for Acquisition of Sensitive Habitats

OBJECTIVE: Provide a list of areas of high, medium, and low priority for protection and/or preservation to maintain a viable, diverse ~~avifauna~~ in Prince William Sound and other oil-impacted areas.

BACKGROUND: ^{may} Long-term restoration plans for ~~avifauna~~ in the spill areas include reduction in timber harvest, acquisition of islands intensively used by colonial nesters, ^{info. birds} eradication of introduced predators from islands with ground-nesting colonial birds, and reduction of human disturbance in sensitive areas. → The USFWS has begun a process of prioritizing where these sensitive areas are in relation to ^{existing} long-term plans for acquisition or providing protective status. However, given the added stress of the oil spill and imminent increase in logging + ^{add cultural + recreation, fish + shellfish, etc.} other development activity, the time frame for this ^{need} planning process has been ^{information} shortened. ^{become more urgent.}

PROPOSAL: Information from several agencies (USFWS, ADFG, USFS, ^{THRU} NPS, DEC) will be gathered and collated to identify areas of particular sensitivity to ~~avifauna~~ in the spill area. In particular, prioritization will be given to which areas in which logging should be restricted either by permitting or ^{development} purchase of timber rights, where predator eradication efforts should be concentrated, and ^{WHERE} ~~what~~ additional lands ^{THRU} should be included in the National Refuge, State Parks, National Parks, or National Forest systems or ^{otherwise} given greater protective status.

^{rocks, develop activities}
^{serve as a key basis/reference for a variety of}
This is a ~~low-cost~~ project ~~and~~ would primarily involve staff time with little need for further field work at this time. It would ^{IDENTIFYING} ~~benefit~~ future restoration efforts by having a consensus among agencies of where to focus further work. ^{replacement/acquisition} ^{to the greatest benefit}

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5 April 1990

EST \$50K-100K

*Don't need to
do a study*

Pilot Project 1990 -- Bird studies

TITLE: Predator Control at Breeding Bird Colonies

OBJECTIVES: Reduce the number of introduced predators on selected islands to enhance success of reproduction of ground-nesting colonial seabirds.

BACKGROUND: Many of the small islands along the Kodiak Peninsula and in the Aleutian chain have had predator species of mammals introduced during the last 100 years. For example, foxes and rats have become abundant on several of the islands. Eggs and chicks of ground-nesting colonial seabirds are a preferred prey item for these mammalian predators. Removal of introduced predators by the USFWS in past years has resulted in as much as a 900% increase within 5 to 10 years of the numbers of eiders and cormorants on an island. This appears to be a cost effective method for acquiring equivalent resources to replace birds lost in Prince William Sound due to the 1989 oil spill. For example, red-legged kittiwakes, pigeon guillimots, and common murres all suffered a reduction in breeding success during the oil spill year. Predator control on islands outside the spill area would ~~more~~ quickly replace the immediate and long-term loss of birds and, hopefully, provide a source from which birds could recolonize the Sound when food resources and breeding areas return to optimal condition.

*direct
mortality
and*

*enhancing the
prod. of
ground-nesting seabirds
in order to*

PROPOSAL: Several islands will be selected that have ground-nesting colonial seabird populations and introduced predators such as foxes and/or rats. Predator control would be initiated on several of the islands while others would be monitored and used as controls. Foxes would be controlled through trapping and hunting while rats would be controlled by trapping and/or poison baits (note: USFWS has standard protocols for predator control measures). Colony size, nesting success and phenology, and recruitment of young would be measured on all islands. The change in these parameters over a two year period would be compared between the controlled and treated islands to document whether predator control had a significant effect.

Cost and personnel is surprisingly minimal for this type of effort. USFWS estimates that it costs approximately 12K for predator removal from each island. Additional costs would be incurred in monitoring the seabird colonies. Total cost is estimated at 100K/yr for two years (to include 5 islands, 2 controls and 3 treatments).

Pilot Project 1990 - Mammals

TITLE: Sea Lion/Harbor Seal Habitat Protection

PURPOSE: To study disturbance and effects of disturbance on sea lion or harbor seal rookeries. Determine and identify factors that are influencing these areas currently, and may influence them in the future. These factors will be documented to bring the current existing data base up to date.

BACKGROUND: Both sea lion and harbor seal populations have been declining in Alaska. Consequently, any additional risk from the oil spill will accentuate this decline. For example, long term chronic effects on reproduction have not been documented, however, this is a potential long-term effect that would ~~cause~~ *contribute* population decline.

RATIONALE: The object of this study is to identify the habitat use, and document the disturbance to the populations using this habitat in order to develop measures to preserve habitat critical to successful reproduction of the species. General information is needed to document the types of use of each area by the animals. In addition, human disturbance, such as boat traffic and noise, must be documented. In addition, obvious effects on the animals such as interruption of nursing cycles, change in habitat use, and pup mortality should be documented.

Once this information is obtained, it will justify the preservation and protection of these critical habitats through possible acquisition or protection by *managing* minimizing the disturbance through restrictions on use or access.

APPROACH/STUDY DESIGN: Two sites will be selected representing both a disturbed area, and an undisturbed control area. Areas for consideration include, for example, Marmot Island which is an established sea lion rookery with some known disturbance. A field team would be at each area documenting such things as types of use of the area by the animals, (reproduction and rearing of young) and any obvious effects on these activities from disturbance. During the first year, observations would start prior to the time of pupping, approximately June 1, and would continue for about three to four months. Pup mortality will be monitored for one to two years following this initial season.

RESOURCES REQUIRED: Estimated cost of this project is \$125,000. resources are needed to support two field crews (one at each site), including transportation, subsistence, and salary. In addition, any special equipment, such as radiotransmitters, may be needed. Data analysis will be needed.

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Title: Prince William Sound Harlequin Duck Breeding Habitat
Analysis Pilot Study

Study ID Number: Bird Study Number 11

Change

Project Leader: Dr. Samuel M. Patten

Leading Agency: Alaska Department of Fish and Game

Cooperating Agency: U.S. Fish and Wildlife Service

Cost of Proposal: 10K

Date of Plan: April 12, 1990

Principal Investigator: _____ Date: _____

Organization Leader: _____ Date: _____

Organization Financial Officer _____ Date: _____

II. INTRODUCTION:

This focus of proposal is a pilot study for restoration of Harlequin Duck (Histrionicus histrionicus) populations in Prince William Sound (PWS). Harlequin Ducks are year-around residents in Prince William Sound (Isleib and Kessel, 1973), feeding in heavily impacted intertidal zones resulting from the Exxon Valdez Oil Spill (EVOS) and breeding along nearby streams (Hogan, 1980). In addition to direct mortality associated with the EVOS, preliminary damage assessment results from Bird Study No. 11 suggest that a significant proportion of the Harlequin population surviving in oiled areas is in physiologically poor condition, probably associated with consumption of oiled intertidal prey items.

Harlequin Ducks, because of their resident status and intertidal foraging habits, have been considered substantially at risk to effects of the Exxon Valdez Oil Spill (King and Sanger, 1979). Harlequin Ducks are dependent upon intertidal marine invertebrates (Vermeer and Bourne, 1982). Harlequins consume a wide variety of small mussels, clams, snails, and limpets (Koehle, Rothe and Dirksen, 1982; Dzinbal and Jarvis, 1982). Bivalves, particularly blue mussels (Mytilus), and small clams (Macoma), are well-known for their ability to concentrate pollutants at high levels (Shaw et al, 1976). The crude oil spilled from the Exxon Valdez may cause severe damage to marine invertebrates that support Harlequin Ducks (Stekoll, Clement, and Shaw, 1980) and bioaccumulation in the food chain may result in uptake of petroleum hydrocarbons by Harlequin Ducks over a long period (Dzinbal and Jarvis, 1982; Sanger and Jones, 1982).

Bird Study No. 11 is determining levels of petroleum hydrocarbon ingestion by sea ducks, including Harlequins, and predicting resultant physiological and life-history effects (Hall and Coon, 1988). Pre-oil spill baseline data is fortunately available on petroleum contaminant levels of Harlequin Ducks in Prince William Sound (Irons, USFWS, pers. comm.).

Preliminary results from gross necropsies of intertidal feeding Harlequins collected in oil-impacted areas of western Prince William Sound in early winter 1989-90 suggest approximately 25% of these birds were in poor physiological condition. By comparison, approximately 97% of Harlequins collected in winter 1989-90 in unexposed areas of southeastern Prince William Sound and near Juneau were in good condition. Collected White-winged Scoters, which feed in deeper water on benthic invertebrates (Sanger and Jones, 1982) were in good condition in both exposed and unexposed areas of Prince William Sound. These preliminary damage assessment results are in accordance with theoretical predictions of effects of petroleum exposure through the food chain to higher trophic level intertidal predators such as Harlequin Ducks.

USFWS and ADF&G biologists attending the initial Oil Spill Restoration Planning meeting in Anchorage (April 3-4, 1990) identified the lack of knowledge of Harlequin Duck breeding habitat ecology in Prince William Sound as being a critical data gap which needs to be addressed before restoration efforts can proceed for this species. This proposal for a pilot study analysis of Prince William Sound Harlequin Duck breeding habitat is the first step to address that requirement.

Harlequin breeding habitat in Prince William Sound may need protection as part of restoration efforts aimed at rebuilding population numbers, yet little is known about Harlequin breeding parameters other than they nest along forested streams. A single study has been conducted on the breeding ecology of the Harlequin Duck in Iceland (Bengston, 1966). Specific information is lacking about Harlequin Duck breeding in Alaska, other than Dzinbal and Jarvis' (1982) work on summer coastal feeding ecology. Increase in knowledge about this topic received a priority rating by biologists attending the initial EVOS restoration planning meeting in Anchorage. Harlequin nesting streams in Prince William Sound need special protection from impending logging activities if this seaduck population is to recover from the 1989 Exxon Valdez Oil Spill.

In response to this priority identification, Bird Study No. 11 is prepared to proceed with a limited feasibility study in the 1990 field season, to commence before June 1. This would be considered an additional, although limited, objective for Bird Study No. 11, and would require minimal additional funding in 1990. An experienced waterfowl biologist and a technician from Bird Study No. 11 are planning to be in the field in Prince William Sound investigating Harlequin Ducks in oiled areas throughout the summer. Boats, motors, and field gear have previously purchased.

A considerable amount of information concerning anadromous fish streams (where Harlequins would nest) is available from Commercial Fisheries and Habitat Divisions of the Department of Fish and Game. Early spring and summer surveys of streams along which Harlequins are expected to nest would involve minor logistical planning changes to a field program already in place for the 1990 summer season. This breeding habitat analysis pilot study would enable the biologists to gather some data on Harlequin breeding ecology, and enable aspects of a larger 1991 restoration study to be assembled.

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III. OBJECTIVES:

- A. To locate, identify and describe Harlequin nesting streams in Prince William Sound.
- B. To identify habitats used by nesting Harlequin Ducks including stream, riparian, and adjacent forest types.
- C. To investigate Harlequin Duck breeding parameters such as distance from the coast, distance from the stream, and physical features of the nest site.
- D. To obtain limited data on Harlequin breeding productivity where possible, such as clutch size, hatching and fledging success.
- E. A postulated objective for the the larger restoration feasibility study would be the recommended size of forested buffer strips to protect Harlequin breeding streams from the effects of impending logging in Prince William Sound.

Logging effects could significantly retard or thwart efforts to restore the population of Harlequin Ducks in Prince William Sound after the EVOS. Riparian forest zones or stream conservation easements could be obtained as part of the "acquisition of equivalent resources" oil spill restoration program. Many other wildlife species other than Harlequin Ducks would benefit.

- F. Identify potential alternative methods and strategies for restoration of lost use, populations, or habitat.

IV. METHODS:

- A. Sampling Methods:
Streams will be selected for investigation based upon reported concentrations of Harlequins in the vicinity and interviews with knowledgeable observers.
- B. Citations:
See section VIII.
- C. Standard Operating Procedure Requirements:
None. This is a preliminary survey.
- D. Equipment Protocol:
A 20-ft. center-console fiberglass boat will be used as transportation during this study. The boat will have appropriate safety and survival gear, marine VHF radio, and depth finder. An outboard powered inflatable boat may be used in protected areas in addition to the larger craft.

- E. Quality Assurance and Control Plans:
Data will be recorded in standard formats. Chain-of-custody procedures as outlined in State/Federal Damage Assessment Plan Analytical Chemistry QA/QC will be followed.
- F. Information Required From Other Investigators:
Data on Harlequin distribution may be requested from U.S. Fish and Wildlife Service aerial surveys of Prince William Sound. Interviews will be conducted with Commercial Fisheries personnel experienced with Prince William Sound stream surveys. Other agency or private biologists working in Prince William Sound and having knowledge of Harlequin Ducks may be consulted.

V. DATA ANALYSIS:

- A. Tests:
This is a preliminary investigation to determine the feasibility of a larger program. Statistical tests are not planned until the form of the data to be gathered is obtained.
- B. Analytical Methods:
Not known at the present time until preliminary surveys are completed.
- C. Products:
The products of this study will be a narrative report with maps, figures, and tables.

VI. Schedules and Planning:

- A. Data Submission Schedule:

Fieldwork	May 15, 1990 to Sept. 30, 1990
Analyze Data	Oct. 1, 1990 to Dec. 15, 1990
Complete Interim Report	Feb. 15, 1991
- B. Special Reports:
Additional interim reports and communications will be prepared by the PI as desired by the Management Team. If warranted, a proposal for a complete Harlequin breeding inventory may be developed by spring 1991 as part of restoration efforts.
- C. Visual Data:
None.

D. Sample and Data Archival:
Samples and data will be archived at the Department of Fish and Game.

E. Management Plan:
This study will be conducted and managed by the Principal Investigator who will work under the general guidance of the Division of Wildlife Conservation Oil Spill Damage Assessment Management Coordinator. The Management Coordinator will provide general supervision during planning, implementation, and reporting phases of the study. The Principal Investigator and assistants will collect the field and laboratory data, and prepare and handle specimens. The Principal Investigator will interpret results, and write draft and final reports. General guidance may also be provided by the DWC Waterfowl Coordinator. The Principal Investigator may be also assisted in field and laboratory work by one or more DWC biologists or technicians.

F. Logistics:
The Prince William Sound aspects of this study will be conducted from Whittier and Cordova, with the Department of Fish and Game facilities at Main Bay Hatchery, located in the oil spill area of western Prince William Sound, providing a secondary base of support. A field camp will be constructed on Knight Island in summer 1990. Transportation will be from a center console fiberglass boat. This boat is designed for open water operations and can access most of Prince William Sound in good weather. An inflatable boat will be used inshore and in sheltered waters. Aircraft or larger vessel charter may be used to access streams distant or difficult by small boat.

VII. Budget:

A. Costs:

Salaries	included in Bird Study No. 11
Travel	included in Bird Study No. 11
Contracts	5,000 (aircraft or boat charter)
Supplies	2,500 (boat gas, food, etc.)
Equipment	2,500 (boat repair and maintenance)

TOTAL

\$ 10,000

B. Personnel:

1. Samuel M. Patten
2. Wildlife Technician/Field and Laboratory Assistant

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C. Qualifications:

1. Principal Investigator - Samuel M. Patten
Sam Patten received his B.A. degree from Cornell University in 1968, majoring in Biology and German. He attended Heidelberg University 1968-71. In 1971 he began work as a Research Assistant at the University of Washington, conducting thesis research on Glaucous-winged Gulls in Glacier Bay National Monument under National Park Service sponsorship. He received his Master of Science degree in 1974.

He worked as a Research Associate for the University of Alaska in the summer of 1974, conducting research on avian populations on the outer coast of Glacier Bay for the National Park Service in an area potentially impacted by nickel mining. In 1975 he began research on gulls on the south coast of Alaska as a doctoral student at Johns Hopkins University. Field work was conducted as part of the NOAA-OCS gas and oil baseline studies prior to the development of oil resources. He received his Ph.D. in Animal Ecology and Behavior from the Department of Pathobiology, School of Hygiene and Public Health, Johns Hopkins, in 1980, with a dissertation on the evolution of gulls in Alaska.

Patten continued work on seabirds, shorebirds and waterfowl in Yakutat, Alaska, for Operations Research, Inc., 1980-81, under NOAA contract. He assisted in production of a data atlas of the Bering, Chukchi, and Beaufort Seas for NOAA while at the University of Alaska 1981-82. He also conducted research on avian populations in the Susitna basin, as part of the hydroelectric project, for the University of Alaska Museum in 1982. He began working for the Department of Fish and Game as Area Biologist on the Yukon-Kuskokwim Delta in 1983, conducting a cooperative management program instrumental in the population recovery of four species of geese. This management program also led to the expansion of muskox, moose, and caribou populations on the Yukon-Kuskokwim Delta through 1989. Since May 1989 he has been working on seabirds and waterfowl as a Division of Wildlife Conservation research biologist in the Oil Spill Impact Assessment and Recovery (OSIAR) program, as a result of the Exxon Valdez Oil Spill.

VIII.

CITATIONS:

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Hogan, M.E. 1980. Seasonal habitat use of Port Valdez, Alaska by marine birds. Unpublished administrative report. U.S. Fish and Wildl. Serv., Anchorage, Ak. 25 pp.

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D.J. Sheehy
Versar, Inc.
13 April 1990

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PILOT PROJECT - 1990 FISH/SHELLFISH

Title: Artificial Reef Evaluation

Purpose:

This project will evaluate the feasibility of providing artificial reef and/or SAV habitat to replace habitat damaged or degraded as a result of the Exxon Valdez oil spill. The proposed pilot project will include the construction and evaluation of an artificial reef placed in Prince William Sound. The specific objective of artificial reef placement is to test the hypothesis that rockfish or other fish and shellfish species will use reefs as shelter and/or feed on the forage base that is 1) concentrated by or attracted to the reef, 2) develops on the reef surface, or 3) uses this fouling community as microhabitat. This demonstration project will determine the effectiveness of this habitat replacement approach for future restoration in Prince William Sound.

Statistical tests will be used to compare the differences in the composition and abundance of fish and shellfish on reef and non-reef control sites. Fouling plates will be used to document the development of a fouling community on the reef and stomach contents analyses will be used to determine the diet of target recreationally or commercially harvested species that utilize the reef. The fish utilization will be documented using diver/ROV observations, time lapse photography, and acoustic surveys. *+ reef?*

Rationale:

The Exxon Valdez oil spill has damaged habitat that is critical to some fish or shellfish species or life stages. The nature, extent, and consequence of this damage is currently under investigation. This project will provide information that can be used for restoration if the results of on-going damage assessments indicate significant damage.

The potentially damaged fishery habitat types that are of known importance include rockfish reefs, herring spawning areas, and salmon spawning/nursery areas. Artificial reefs or SAV beds are possible interim restoration measures that may provide additional habitat to replace at least some of the functions of the reef or rocky subtidal habitat lost or damaged as a result of the oil spill. These measures are temporary substitutes that may replace some of the critical habitat functions, such as cover and concealment (reduced predation), forage, or ovideposition substrate that have been lost damaged or degraded.,

Rocky reef areas exposed to oil from the Exxon Valdez spill were used by rockfish as well as other demersal fish and shellfish. Rockfish used these areas for cover and concealment, as well as forage. The shallow reef habitat and surrounding benthic areas that provide forage base have been exposed to oil and may be adversely affected for some unknown period of time. Dead rockfish recovered after the Exxon Valdez spill were diagnosed as killed by spilled oil. Preliminary damage assessment results demonstrated the presence of hydrocarbons in the bile of rockfish several weeks after the spill indicating the possible presence of hydrocarbons in the food chain.

The rationale for the use of artificial reefs is based on the premise that the addition of alternate habitat or the provision of alternate forage outside the spill area may aid in maintaining local fish and shellfish stocks until natural recovery or other restoration measures result in the return of the habitat to its pre-spill condition. The maintenance of seed stock within close proximity to currently contaminated areas may aid in the recruitment of fish back to that area as conditions improve.

Background:

Artificial reefs have been traditionally used to enhance commercial or recreational fisheries for both fish and shellfish. Although there has been a continuing debate as to whether reefs attract or increase the production of fish/shellfish, research has clearly demonstrated that for selected species that are dependent on reef habitat for cover/concealment (e.g. American lobster; Homarus americanus) or feed directly on the encrusting community (e.g. tautog; Tautoga onitis) artificial reefs can increase local carrying capacities. In fact, well designed artificial reefs function in a manner identical to natural reefs. The primary difference between natural and artificial reefs in temperate waters is not function, but the manner by which the materials were originally placed.

Recent studies (Sheehy and Vik, 1988, 1989) have suggested that prefabricated designed reefs may be useful tools for mitigating the adverse effects resulting from the loss or damage of coastal habitat. Prefabricated structures (Sheehy, 1983) designed specifically to function in providing shelter or concentrating food can provide substitute habitat for a variety of species that may have been impacted by or displaced as a result of the Exxon Valdez oil spill. These would include demersal rockfish and nearshore forage species dependent on SAV for shelter or spawning habitat. It has been demonstrated that SAV beds afford not only protection from predators but also provide a rich foraging habitat (Rozas and Odum, 1988). Artificial reefs or SAV structures that replicate the physical form or characteristics of natural reef or SAV provide many of the same functions as this natural habitat.

Approach:

One approach to replacing contaminated reef habitat or providing additional habitat outside of areas that have been impacted by oil contamination is the construction of artificial reefs or SAV beds. This pilot project will deploy two or more artificial reef or SAV modules in order to operationally test and evaluate this technology in Prince William Sound. Performance evaluations of these structures will determine whether or not these units are utilized by rockfish or other species. Artificial reef or SAV modules could be placed either on impacted substrate or in areas that have not been exposed, but are devoid of natural habitat structure. The reef performance evaluation will document occupancy and utilization of the reef by fish and shellfish, examine the development of the fouling community on the reef, examine stomach content of target species, and collect tissue samples for hydrocarbon analysis.

The project is composed of the following specific tasks:

- o Coordination with State resource agencies to determine potential test and control sites, schedule, and local participation. Prepare and submit permit applications.
- o Conduct pre-placement site surveys to characterize substrate and fauna. Confirm oceanographic conditions for stability analyses.
- o Based on site conditions, configure a selected artificial reef/SAV module design to meet site stability conditions and target species requirements. This study will consider only existing, proven and tested prefabricated reef/artificial sea grass technology; no product development is contemplated at this time.
- o Specify module design or configuration and order components and construction materials.
- o Build reef/SAV units using local labor, if available. Place reef/SAV modules at permitted sites. Conduct initial post-placement inspection.
- o Conduct post-placement surveys. Video, acoustic, angling, and diver transect fish surveys are anticipated, depending on site depth and conditions. Fouling plates and other monitoring equipment (settling tubes, azoic sediment trays, etc.) deployed with the reef unit would be sampled seasonally. Stomach content and tissue samples from collected fish would be retained for future analysis.

The results of the proposed study will determine whether or not rockfish and/or other species occupy and utilize artificial reefs or SAV beds. The null hypothesis to be tested will be that there is no difference in species composition and abundance between the artificial reef and non-reef control sites. Earlier

work strongly suggests that a significant difference between test and non-reef control sites will be detected. This information will also be useful to compare with the rates of natural recovery on existing oil impacted reefs. If results indicate this method is effective, information needed to scale and determine the cost of future artificial reef/SAV application will be available.

Resources:

	FY90	FY91
Equipment and Materials	\$ 70 K	\$ 15 K
Travel	15 K	15 K
Personnel	50 K	30 K
Subcontract	35 K	
Total	\$170 K	\$ 60 K

References:

- Rozas, L.P. and W.E. Odum. 1988. Occupation of submerged aquatic vegetation by fishes: testing the roles of food and refuge. *Oecologia* 77:101-106.
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